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SCIENCE AND TECHNOLOGY

BULGARIA: ACTIVITIES OF CENTRAL INSTITUTE FOR CHEMICAL INDUSTRY

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ACTIVITIES OF CENTRAL INSTITUTE FOR CHEMICAL INDUSTRY

Quality, Efficiency, Leadership

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[Article by Georgi Pankov, minister of chemical industry]

[Text] The Central Institute for Chemical Industry is a head institute within the system of the National Chemical Industry Corporation. It is making an active contribution to the overall development of the sector. The institute is making systematic and persistent efforts to develop a unified scientific and technical policy in the sector and to enhance the level of scientific developments and their accelerated practical utilization in upgrading the efficiency and export possibilities of the chemical complex.

Throughout its existence, the collective of the Central Institute for Chemical Industry has shown a high feeling of responsibility for its assignments related to the development of chemical production facilities. The leadership of the National Chemical Industry Corporation positively assesses the results of the scientific and application activities of the TsIKhP [Central Institute for the Chemical Industry] specialists. The long efforts of the collective and its stressed and systematic application work are yielding significant economic results. In 1983 alone the TsIKhP achieved more than 10 million leva in confirmed economic results. Furthermore, through its developments the institute is actively contributing to the use of chemicals by the consumers and the expansion of the domestic and foreign markets. Thus, for example, in 1983 technologies aimed at improving production quality were applied with economic results totaling 7.7 million leva; raw and other materials and energy savings totaling 6.8 million leva and foreign exchange savings of 7 million leva were achieved. Through its active efforts in providing information services, forecasting and social disorganization of labor and standardization, the TsIKhP is making a significant contribution to the systematic advancement and enhancement of the sectors' management standards.

Since the purpose of scientific and technical thinking is to outstrip and to guide the development of a sector, the role and responsibility of the scientific and technical potential, those of the TsIKhP in particular, are exceptionally great.

A union of 12 scientific institutes and eight economic and trade organizations was created to coordinate scientific and engineering-application services. The TsIKhP is the leading member of the association for coordinated, cooperated and joint scientific and engineering-application servicing in cadre training and developing and applying new technologies for raw and other materials and products of the chemical industry. This is an expression of trust in the cadre scientific potential of the institute, which developed in the course of 3 decades. It is also a serious obligation facing its collective. The implementation of this responsible assignment requires the prompt organization of scientific activities, which enables us systematically to study and respond to consumer demand, constantly to watch the pulse beat of the production process and to compare its achievements with world standards in their dynamics, continuingly to submit new technological solutions and put them to practical use without delay and always seek possibilities of multiplying achieved results.

What are the basic topics on which the Central Institute for the Chemical Industry should concentrate its efforts in order to fulfill these difficult and responsible assignments and with a view to the further strengthening of science-intensiveness within the National Chemical Corporation?

First of all, in connection with the chemization of agriculture, we must work on the creation of new technologies for highly effective chemical fertilizers; the creation of liquid and suspension fertilizers, including fertilizers for leaf nutrition; improving the physical and mechanical properties of solid fertilizers; developing nitrogen and phosphorus slow-acting fertilizers, fertilizers with microelements, organic-mineral and chlorine-free potassium fertilizers; and expanding the raw material base of the fertilizer industry with local raw materials. Together with the NAPS [National Agroindustrial Union], we must begin work on new types of fertilizers and new technologies for their production, which will be of particular interest after the year 2000.

Other very topical problems are those involving the development of new and efficient technologies for the comprehensive processing of local raw materials and waste for the production of mineral salts and inorganic pigments and fillers.

Currently and in the years to come, developing a technology for mastering the production of new low-volume organic products--semifinished products for synthesizing dyes, plant protection chemicals, etc.--is and will be considered of particular importance.

The collective of the TsIKhP bears a great responsibility for the development of microbiology and for organizing the production of microbial protein.

The TsIKhP must continue to intensify its work on the creation of new and modified polymer materials and goods--new materials based on foam plastics, modified polymers, new compounds for the medical and shoe industries, artificial marble and electric conductor materials based on polymers, new types of polycondensation and brands of polymerization resins. Equally important are problems related to extending the service life and improving the

quality and reliability of polymer materials and goods. Studies to be conducted in the future on the synthesis and application of polymer additives will assume increasing importance.

The creation of new auxiliary facilities for industry, construction, consumer goods, etc., is an essential trend in the institute's work.

It would be expedient for the institute to consolidate and intensify the work done so far on environmental protection problems and the utilization of waste products. The optimal comprehensive solution of ecological and economic problems related to the production of chemicals is an exceptionally responsible and a serious task.

The Central Institute for Chemical Industry has proved that it has the necessary strength and possibility of meeting the requirements it faces and to work successfully along these lines. The planned development of its material and technical base is a prerequisite to this effect. The main prerequisite, however, is the further development and optimal utilization of its cadre scientific potential by enhancing qualification standards, creating comprehensive collectives with the participation of specialists from chemical and other sectors, the Bulgarian Academy of Sciences and the VUZs, and intensifying and expanding cooperation with related institutes in the fraternal socialist countries, the USSR above all.

Chemical Institute Activities

Sofia KHIMYA I INDUSTRIYA in Bulgarian No 8, 1984 pp 342-343

[Article by Dacho Dimitrov, Central Institute for the Chemical Industry general director]

[Text] The year 1954 is considered the institute's birthdate. That year the Institute for the Chemical Industry was created on the basis of the laboratory of the Chemical Industry DSP [State Economic Trust], answering the ripe need to provide scientific services to the Bulgarian chemical industry which was developing at an accelerated pace.

An important feature in its history was Directive No 33 of the Council of Ministers, dated 5 June 1979, on the creation of a Central Institute for the Chemical Industry, with the following object of activities: study, scientific research, design, development of technologies, experimental production and application of scientific and technical achievements in the chemical industry. The creation of the TsIKhP was the answer to the qualitatively new requirements governing the system of scientific management, the needs of the chemical complex and the application of the new economic approach in scientific research and engineering-application activities.

Over the past 30 years the institute developed as the main scientific unit and leading engineering-application organization within the chemical industry system. It became a sought-after partner by plants and combines not only within the chemical complex but in the other industrial sectors and agriculture as well.

The development of qualitatively new advanced, low-waste and wasteless technologies, which enhance the technical standards of the production process and upgrade its efficiency, assumed a main role in the topic plan of the TsIKhP for the 8th Five-Year Plan.

Essentially new and improved raw materials, materials and goods were developed; work was done to reduce the weight of structures; surrogates for scarce imported raw and other materials were used and the share of local resources was increased and secondary and waste products were maximally utilized.

Every year the Central Institute for the Chemical Industry introduces in the national economy 35 to 40 new technologies for the production of plant protection chemicals, dyes, optical bleaches and semifinished products for them, auxiliary facilities for industry and construction, polymer structures for the struggle against corrosion, and rubber, plastic and other goods.

In 30 years of active creative efforts, the TsIKhP has applied a large number of developments, more than 350 between 1971 and 1983 alone, with total benefits in excess of 18 million leva per year and 21 million leva in foreign exchange.

Following are some of the more important applied developments: production of superphosphate-phosphorite fertilizer, liquid fertilizer of the Fikhal type, eight different brands of optical bleaches, which will meet in full the needs of the country starting with 1985, seven plant protection chemicals, a range of furan resins for self-hardening casting mixtures, various sizes of wheelbands for electric cars and for reducing rolling friction losses, production of conveyor belts, including antistatic and fireproof for coal mining, rebuilding of pneumatic tires, including large ones, various types of armored rubber and plastic hose, high-grade rubber thickeners, medical plastic items, pallet cases for the textile industry, alkagen- and glass-reinforced polyamide, glass-reinforced polypropylene, Hydroflex, a hydroinsulation construction product, thermostabilizer and thermostabilized polyamide cord and others.

The developments applied in 1983, related to improving the quality of output, have proven economic benefits of 7,676,000 leva, and developments which reduce outlays of raw and other materials and energy can result in benefits totaling 6.8 million leva and savings of 6,570,000 leva in foreign currency.

The TsIKhP has made a considerable contribution to agricultural chemization with the development and application of some fertilizers, plant protection chemicals and plastic and rubber items.

In 1982 the SKhK [Agricultural Chemical Combine] in Devnya started regular production of superphosphate-phosphorite fertilizer. In terms of agrochemical qualities it equals superphosphate, but with a lesser solubility, which means lesser losses in the soil and lower production costs.

Fiksal, a liquid fertilizer, brands A and B, was introduced jointly with the SKhK in Stara Zagora. It is used as nutrition for plant leaves. In 1983 alone 2,000 tons of this substance were produced with benefits of over 2 million leva for the producer alone.

In 1983 the SKhK in Vratsa undertook the production of additives and noncompacting carbamide with benefits equaling 3 million leva. Our chemical industry is producing a significant number of KhSZR [Plant Protection Chemicals] developed by the TsIKhP, as follows:

EM-80 emulsion insecticide oily preparation, in which companies in England, Cuba, Romania and others have become interested;

A water-oil ceazin--a corn herbicide;

Betaphor 20--an insecticide for the struggle against the beet weevil (the sugar beet seeds are processed with this preparation before sowing);

Tetranicid 202, for the struggle against mites;

Pravap, used in the struggle against the whitefly;

Oleophen 205--an insecticide used against wheat pests;

IKhP-300--a chemical for the preservation of stored fruits, which reduces weight losses in apples by more than 17 percent.

In 1983 the newly built installation at the Agriya KhZ [Chemical Plant] undertook the production of the insecticide Chloroacetophenone 50, with an original Bulgarian active agent developed by the TsIKhP collective.

Between 1980 and 1983 alone seven plant protection chemicals were developed providing overall economic benefits of 3 million leva for the producer alone and savings of foreign exchange from capitalist countries in excess of 1 million leva.

A technology for the production of the herbicide Alachlor was developed and submitted to the MKhP [Ministry of Chemical Industry] and the Agriya KhZ; the herbicide Naphthal 25H is about to be produced. Technologies for pesticides Methyltopsin, Stomp, Baileton and others are being developed under laboratory and semi-industrial conditions.

The institute's collective has made a significant contribution to the chemization of metallurgy and machine building. A number of products and items have been applied: new highly efficient polymers, such as high-alkali polyamides, glass sealed polyamides and polypropylene, glass filled pressed material based on phenol resins, etc. Ecological equipment made of fiberglass has been applied, such as absorbers, tubes, stacks, etc.

The Dimitur Filipov Plant in Berkovitsa uses novolak phenol-formaldehyde resins in the production of high-speed abrasive discs; liquid resol resins,

developed by the institute, are used as a moistening agent for the abrasive grain.

Good cooperation with the Zebra SKKI resulted in the regular production of full-rubber tires of improved operational quality, riding comfort and minimal friction losses. This lowers the consumption of electric power and expands the useful life of electric cars.

Based on the institute's development, three basic types of furan resins in seven modifications are produced for metal casting: FKFF-2, FKRR-2M, FS-10, FS-101, FS-20, FS-201 and FS-30, as well as sulfoxylic, sulfophenolic and paratoluenesulfonic acid catalysts, totaling more than 2,000 tons per year.

Work on the production of microporous separators for battery manufacturing is in its advanced stage. The use of separators will double the useful life of batteries and, hence, result in significant savings of raw and other materials.

Some of the applied developments and goods produced at the Kostenets KhZ, which is a branch of the TsIKhP, are contributing to the chemization of the textile industry.

The production of improved groups of dyes and updating and expanding some of the current varieties will make possible a significant increase in dye production between 1987 and 1990.

In 1983 the chemical plant in Kostenets applied a method for producing dyes in a dust-proof commercial variety. This development is of significant ecological importance for producers and consumers.

Studies are under way and technologies are being developed for obtaining eight brands of direct-application nonbenzidine dyes, so that gradually the existing variety of such dyes based on benzidine will be replaced starting in 1985.

The increased requirements of the leather and fur industry required the development of technologies for obtaining synthetic dyes especially for these sectors. By 1986 five brands of this type of dye will be produced on a regular basis, thus eliminating 80 percent of imports.

This year semi-industrial tests will be completed and in 1985 regular production will be undertaken of six brands of 1:2 metal-containing dyes which will cover the basic color range. An original technology has been developed for the manufacturing of such dyes. The finished commercial products will be based on wasteless technology. Such dyes will meet our country's requirements and will be exported.

An original technology has been created for obtaining the 4-5 nitro-2 aminoanisoles, which will make possible the production of metal-containing dyes and will be used as semifinished products in the production of some brands of general-purpose organic pigments.

The Central Institute for the Chemical Industry has acquired considerable experience in the efficient study and application of advanced Soviet experience and that of the other CEMA member countries. The institute directly cooperates with 11 similar institutes and scientific production organizations: six in the USSR, two in the GDR and one each in Czechoslovakia, Poland and Romania. Joint work is being done on 14 problems, nine of which with Soviet institutes. An installation for the production of plastic hose, reinforced with polyamide fibers, with an 800,000 meter capacity, was commissioned as a result of our cooperation with the Plastik NPO [Scientific Production Trust], the USSR and the Kom ZPP [Plastics Production Plant] in Berkovitsa. Currently we are not only meeting our own needs but are offering on the foreign market both hose and complete lines for their production.

An installation has been built and the production mastered of thick plastic shapes. The Krustan Rakovski ZPP in Elin Pelin is currently mastering the production of systems for spiral pipes of different diameters.

Together with the VNIISS [All-Union Scientific Institute of Sugar Beets and Sugar] in Vladimir, USSR, we are working on the development of a technological process and equipment for porous materials for separators for the battery industry and pipe elements for reclamation and irrigation equipment; together with the VNIISV [All-Union Scientific Research Institute of Glass Fibers] in Kalinin we are developing technological processes and industrial production facilities for preparations and antistatic agents for natural and synthetic fibers and silk; with the NIIKHIMPOLIMER [Scientific Research Chemical Polymer Institute] in Tambov we are developing processes and creating a system for obtaining harmless stabilizers for polymer materials using available raw materials, etc.

Cooperation with such institutes and scientific and production organizations is directly related to the integration between our country and the USSR and the other CEMA member countries. Such production is based on local and available raw materials.

TsIKhP specialists are actively using the advanced experience of leading companies. One of the ways to achieve this is participation in purchasing and using licenses. The institute has participated in the purchasing and application of 15 licenses, mainly in the plastics and rubber industries, with overall benefits of 15 million leva. Particularly valuable in the TsIKhP experience has been the fact that after the license has been applied work continues on upgrading its efficiency and further development.

The contribution of the TsIKhP in the development of the chemical industry has been rated highly by the party and the government. The institute was awarded the Red Labor Banner Order in 1979. It received a second award in 1983 in the joint competition sponsored by the State Committee for Science and Technical Progress and RABOTNICHESKO DELO for the application of significant developments. The same year the institute received three more awards: of the Sofia City Bulgarian Trade Unions Council for implementing the slogan of the Sofia City Party Organization "Institute-Plant-Counterplan"; first prize among engineering-application organizations in the V. Levski and Iskur rayons for

high overall indicators and economic results; and a certificate of the Bulgarian Trade Unions Central Committee, Komsomol Central Committee and Central Council of the Scientific and Technical Union for winning the competition for saving on raw and other materials and energy.

As it celebrates its 30th birthday, the collective of the TsIKhP is clearly aware of its future responsible assignments based on the resolutions of the 12th BCP Congress and the National Party Conference on quality for the auccessful application of technical progress, improving the quality of scientific research and output, saving on raw materials and resources, creating new raw materials, materials and products, etc.

The Central Institute for the Chemical Industry will worthily fulfill its assignment, for this is a collective which has profoundly realized the vital need of integrating science with production. The basic principle governing its work is its aspiration toward the new and the continuing and accelerated application of the latest achievements of scientific and technical progress.

Developments in Chemical Industry

Sofia KHIMIYA I INDUSTRIYA in Bulgarian No 8, 1984 pp 344-359

[Introduction by Candidate of Technical Sciences Ivo Zlatanov]

[Text] The Chemical Industry Area holds one of the leading positions in the KsIKhP structure in terms of cadre potential and comprehensiveness of scientific research and engineering-application activities.

With its scientific potential of nine senior scientific associates, 70 scientific associates, 66 university-trained specialists and 14 candidates of sciences, for the past 30 years the Chemical Industry Area in the TsIKhP has resolved and is continuing to resolve a number of problems important to the chemical industry and the national economy.

The main activities of this development are the study, scientific research, development of technologies, experimental production and application of scientific and technical achievements in the chemical industry. The existence of nine sections within its structure makes its activities comprehensive not only within the framework of the chemical sector but in virtually all sectors of our national economy.

The main trends in the activities of this development are the following:

Developing and approving technologies for the production of chemical fertilizers, chemical salts and soda products;

Development of technological processes for the production of low-volume organic derivatives, semifinished products, dyes and plant protection chemicals;

Development of technologies for the production of auxiliary chemicals for industry and construction;

Development of technologies of high molecular compounds and their application in industry;

Development of microbiological processes for the production of proteins, amino acids and enzymes;

Development of technologies for the protection of the environment and water reservoirs from harmful substances;

Development of systems for protecting installations in the chemical industry and the national economy from corrosion;

Development of technologies processes for impulse processing of natural and synthetic organic and inorganic products with a view to improving their characteristics;

Development of methods for control and analysis of technological processes and finished chemical products.

Significant results have been achieved in all areas over the past 30 years.

A number of chemical industry products are manufactured on the basis of technology developed by the institute, with significant results for the national economy.

Superphosphate-phosphorite fertilizer, the Ferizan microfertilizer and the Fiksal liquid fertilizer for leaf nutrition proved their good qualities. Antifoam agents developed in the production of superphosphate and phosphoric acid are extensively used in industry, in Bulgaria and abroad.

Consumer demand for a number of auxiliary items for industry and construction has increased. This includes a thermostabilizer for polyamide cord, pigment pastes for dying synthetic and artificial fibers in bulk, the KP-AS spindle oil for finishing silk manufacturing operations, the Sinterol LSV detergent, the TIB-82 antiadhesive agent, construction compounds with hydrophobic properties, the Beloteks optical bleaches, etc.

Effective plant protection chemicals have been developed, such as the Chloracetophon-B insecticide, Tetranicid-2020 acaricide, Trivavap, and IKhP-300, which is a preparation for the preservation of farm produce.

A range of furan resins was developed in machine building, for the manufacturing of self-hardening casting molds of the FKFF-2 and FS-10, 20 and 30; phenol-formaldehyde resins for abrasive tools BASAD-1, 2, 3; phenol-formaldehyde resins for friction items and hard epoxy resins for anticorrosion use.

Technologies for treating effluent waters at the Kostenets KhZ and the SKhK in Dimitrovgrad and a method for denitration of industrial nitric acid were applied in industry.

These developments alone, which are part of the scientific and applied production in the Chemical Industry Area, have yielded more than 29 million levas' worth of savings for the national economy.

This proves that during those years this area has been truly fulfilling its functions of leading scientific research unit in the chemical sector. It has been a close assistant of the Ministry of Chemical Industry in the development of scientific and technical progress and has implemented the policy of the BCP and the government for the continuing and efficient chemization of the national economy.

The Chemical Industry Area ascribes great importance to contacts and joint work with development and application bases of economic combines, related institutions in Bulgaria, higher educational institutions in our country and abroad, the BAN [Bulgarian Academy of Sciences], the USSR Academy of Sciences and other scientific organizations.

The exclusive principle governing the work of specialists in the chemical industry area and the TsIKhP as a whole is their continuing aspiration for new developments, the application of the latest achievements of scientific and technical progress, enhancing the standards of our chemical output and finding new ways to upgrade the output of chemical enterprises.

The overall activities of this trend, both current and future, will be consistent with existing traditions in this respect and harmonized with Bulgarian state and party policy.

It is in this area that efforts will be concentrated to develop new products, materials and raw materials which will play a decisive role in the future in enhancing the level of the chemical industry and our national economy. This is an expensive yet realistic program, bearing in mind the scientific potential in this area and the opportunities provided by the integration of scientific and production forces.

During the next five-year plan the efforts of the scientific workers and the specialists will be focused on the development of new artificial liquid and suspension fertilizers and mineral salts, the development of new semifinished products for organic synthesis and dyes, the synthesizing of new types of plant protection chemicals and the development of new varieties of auxiliary items for industry and construction.

Technologies will be developed and production mastered of organic silicium semifinished products and finished silicon items. New types of polycondensation resins and products will be synthesized. New porous polymer materials will be developed for the battery industry and membrane technology. New systems for protection from corrosion and new environmental protection technologies will be created.

It is thus that scientific workers in the Chemical Industry Area, closely integrated with the scientific potential and production facilities in the Bulgarian People's Republic, will meet the increased needs of the national

economy for new and effective materials and will contribute to raising the Bulgarian chemical industry to an even higher level.

The results achieved so far, after many years of persistent and dedicated work in the various areas of scientific research and application, which have proved their viability over the past 30 years, are the guarantees for success.

Development of New Types of Chemical Fertilizers

In 1972 a collective was set up at the TsIKhP for work on problems of the fertilizer industry, which achieved significant successes in scientific research and application in this area. Its activities, closely related to the existing production lines and available production capacities, cover above all the development of new technologies and the improvement of technological processes, expanding the raw material base, improving the quality of produced chemical fertilizers, developing and applying liquid and suspended fertilizers, etc.

Following are some of the more important developments and related scientific and technical achievements and results of their application in industry:

New Technologies and Improvements of Technological Processes in the Production of Mixed Fertilizers

Responding to the contemporary trends in the fertilizer industry, and with a view to the more efficient utilization of raw materials, materials and energy, the TsIKhP developed original technology for the production of complex fertilizers on the basis of the decomposition of phosphate raw materials with phosphoric acid in the presence of an ammonium nitrate smelt. This method is protected with an authorship certificate. Semi-industrial tests were made in a large installation and agrochemical tests were conducted. The Khimproekt KIPP [Institute for Comprehensive Study and Design] developed a blueprint for an industrial installation. The planned results of its application exceeds 8 million leva. It was left unused after the NAPS abandoned the use of complex fertilizers.

A number of countries and companies became interested in it, for which reason the development was modified, thus allowing the use of sodium or potassium saltpeter or a mixture of the two instead of ammonium saltpeter. A presentation was made for the benefit of Chile.

After the Plant for Complex Chemical Fertilizers was commissioned at the SKhK in Devnya, the TsIKhP was assigned to provide specific assistance in mastering the formulas for complex fertilizers and to reach planned capacity. A study conducted of all parts of the technological process led to the use of a new system for the recirculation of some of the filtered solution using the chemical energy contained in the phosphoric acid solution and the stabilization of the reaction temperature. A new system was suggested for the precipitation of calcium sulphate in the course of which nitrogen and diphosphoric pentoxide losses are reduced. Savings in excess of 150,000 leva were achieved. The new calcium precipitation method is protected with an authorship certificate.

A technology for the production of slow-acting mixed fertilizers was developed and tested under semi-industrial conditions with a view to upgrading the efficiency of the nitrogen and the diphosphoric pentoxide and reducing losses from washing and the pollution of ground waters. The agrochemical tests were completed with very good results.

In order to compensate for the shortage of humus in the soil, the TsIKhP is developing technologies for the production of organic chemical fertilizers with varying contents of soluble carbon and humic acids. The organic mass used consists of waste hydrolysis lignin and small soft coal fractions. Agrochemical studies are being conducted alongside the development of these technologies.

Technologies for New Types of Phosphoric and Nitrate Fertilizers

A technology for the production of superphosphate-phosphorite fertilizer was developed on the basis of a number of agrochemical studies conducted by the TsIKhP together with specialists from the N. Pushkarov IPPD. The production method is protected with an authorship certificate. Industrial production was developed at the Devnya SKhK, with a savings of 993,000 leva.

Technologies for the production of monopotassium phosphate and calcium nitrate were developed and applied at the SKhK in Stara Zagora for use in greenhouses for hydroponic vegetable growing.

Work is being done on including natural zeolites in the composition of phosphorous fertilizers, the granulation of ordinary superphosphate with an addition of potassium chloride and the addition of various microelements and stimulators in phosphorous fertilizers.

With a view to lowering the solubility of nitrogen fertilizers, studies are being conducted jointly with the VKhTI [Higher Chemical and Technological Institute] in Sofia for encapsulating the water soluble fertilizers with water-insoluble capsules. Also in order to reduce nitrogen losses from washing and in their gaseous phase, studies are under way to develop and use inhibitors of the urease effect.

Improving the Quality of Bulgarian Fertilizers

In relation to the bulk transportation of chemical fertilizers, the TsIKhP has developed a technology for the surface processing of carbamide with a view to its preservation and transportation in bulk. The technology was applied at the SKhK in Vratsa. Savings from this development total 3 million leva. The method is protected with an authorship certificate.

Studies are continuing on improving the physical and mechanical qualities of carbamide.

Work is being done jointly with the VKhTI in Sofia on improving the quality of small-crystal ammonium sulfate through granulation.

The TsIKhP is developing and testing various methods for determining the physical and mechanical qualities of chemical fertilizers.

Expansion and Effective Utilization of the Raw Material Base of the Fertilizer Industry

A highly efficient antifoaming agent has been developed on the basis of domestically available raw materials. It is used in the production of complex chemical fertilizers, triple superphosphate and phosphoric acid. The development was applied at the Verila SKBKh [Economic Combine for Consumer Chemistry] with savings in excess of 12 million leva. This technology is protected with authorship certificates in Bulgaria and the USSR and patents in England and Romania.

Studies were made on the influence of norms, concentrations and temperatures of sulfuric acid on the extraction of magnesium oxide from waste magneside refractory materials for the production of magnesium sulfate used as fertilizer. A technology was developed for its industrial production, to be used at the D. Dimov SKhK.

In order to compensate for the shortage of sulfur containing raw materials, studies were made and the possibility was confirmed of using waste sulfuric acid polluted with organic mixtures in the production of phosphoric acid. Studies are under way to substitute part of the sulfuric acid in the production of phosphoric acid with an ammonium sulfate solution.

With a view to the utilization of effluent catalysts in the chemical industry, technologies were developed for obtaining various microelements or microelement-containing fertilizers.

The industrial production of the microfertilizer Ferizan was undertaken for the struggle against chlorosis. Studies were made on the use of waste lye from the cellulose industry for the production of chelate microfertilizers.

Studies are being made for the application of and technologies are being developed for the use of lean phosphate ores or ores with a rich content of carbonates and silicium dioxide.

Liquid and Suspended Fertilizers

In order to meet more fully the needs of agriculture for new highly efficient fertilizers, the TsIKhP has developed a technology for the production of liquid fertilizers for leaf nutrition, of the Fiksal type, in A and B varities. Along with their main nutritive substances, they contain chelate microelements, vitamins and stimulators. This development was applied at the SKhK in Stara Zagora with benefits totaling 1.6 million leva.

Work is being done on the development of a technology for liquid fertilizers of the UAN type (carbamide-ammonium saltpeter). Studies are under way for the development of basic solutions for liquid fertilizers, which will result in the manufacturing of a broad range of products suitable for a variety of crops.

Production of Soda Ash

Our country is among the largest world producers and exporters of soda ash. This calls for maintaining high standards of equipment and technology, and quickly reacting to and applying all new developments by our plants. To this effect, the TsIKhP has formulated and is implementing a program coordinated with the SKhK in Devya and the Ministry of Chemical Industry. Specialists from the TsIKhP, the KNIP [Complex Scientific Research and Design Institute] and the two soda ash plants are participating in the implementation of the program. The purpose of the program is to apply new developments based on original research. Some new technical solutions achieved in soda ash plants in advanced countries, mainly in the USSR, and their adaptation to our specific conditions, are also contemplated.

The main purpose of the program is to reduce power outlays which are an essential part of production costs. Particular emphasis is put on the utilization of secondary power resources, above all the heat released from the waste distillation in the production of soda ash. Work is being done on reducing the moisture content of the bicarbonate, which is a semifinished product, as a result of which the heat energy needed for calcinating the soda will be reduced. Specialists from the Ministry of Chemical Industry and the VKhTI in Sofia are taking part in these developments.

Another basic trend in research is upgrading the level of utilization of raw materials and reducing material intensiveness in soda production. Work is being done on reducing ammonia losses from waste liquids and gases and lowering outlay norms of active calcium oxide in ammonia regeneration.

The complexity of the problems involved in production intensification and reaching high efficiency requires suitable equipment for the basic technological units. Some new technical solutions will be developed in cooperation with the USSR, where major achievements have been made in recent years. The coordination programs includes the mastery of new contact surfaces for some basic operators within the "absorption-distillation" system, involving heat exchange, distillation and washing the gas flows. The increased useful surface of the mixing reactors within the ammonia regeneration system will reduce the losses of active calcium oxide and ammonia from the residual distillation liquid.

Bearing in mind the fact that the implementation of some program assignments involves a significant reorganization of the available equipment in the crucial technological units ("absorption-distillation," "carbonization-filtration" and "calcination"), capital investments will be required and the application will take place by stages. The reorganization will be accomplished without a complete interruption of the production process.

In order to preserve and expand the positions we have gained on the international market, extensive work will be required in the future to expand variety and improve the quality indicators of our output. In research on improving the quality of soda ash attention is focused on reducing the content

of iron and chlorine-containing admixtures. Consumer requirements concerning such indicators are increasing steadily.

Comprehensive Utilization of Fluorine-Containing Gases

The high increase in the production of fluorine compounds requires the steady expansion of their raw material base. Calcium fluoride reserves, which are the main source of raw material, are becoming steadily exhausted. That is why the problem of the fluorine-containing gases, i.e., gases which separate in the processing of natural phosphates and are an inevitable companion in the production of phosphorous fertilizers or, respectively, extraction phosphoric acid (EFK), is particularly relevant.

According to published data, some countries use 45-55 kilograms fluorine per ton of diphosphoric pentoxide (i.e. 35-45 percent fluorine utilization), compared to no more than 6.25 kilograms achieved in Bulgaria in 1980.

Currently the SKhK in Dimitrovgrad produces 2,000 tons of sodium silicafluoride for a year from gases released in the production of EFK with the dihydrate method.

Scientific research was concentrated on the development of technologies for the production of new high-quality fluorine compounds, which will ensure the fuller utilization of fluorine resources.

A study conducted at the shop for the production of EFK on the basis of African phosphorites (the dihydrate method) at the Devnya SKhK in 1977-1978 proved the possibility of utilizing 12,000 tons per year of fluorine in the form of concentrated hydrosilicofluoric acid.

Technologies for the production of aluminum fluoride, cryolite, ammonium fluoride-bifluoride, sodium fluoride and silicium dioxide based on hydrosilicofluoric acid and potassium silicofluoride were developed between 1975 and 1983. The technological stipulations for the manufacturing of such products were adopted.

Production of Ammonium Fluoride-Bifluoride and Silicium Dioxide--"White Ash"

Laboratory and semi-industrial studies conducted by the TsIKhP indicate that high-quality ammonium fluoride-bifluoride and silicium dioxide (known as "white ash") may be obtained from 10 percent hydrocilicofluoric acid and 25 percent ammonia water. The neutralization takes place at a temperature of 60-65 degrees C. The thus-obtained "white ash" underwent physical and mechanical tests at the Chavdar DKZ [State Rubber Products Plant] in Svetovrachene, with a view to its utilization as a filler in rubber compounds. The results indicate that silicium dioxide has indicators consistent with Bulgarian state standards and its effect equals that of imported Vulcanisal S (Bayer--FRG).

Production of Aluminium Fluoride

Laboratory experiments and pilot tests led to the production of high grade aluminum fluoride using the acidic method--by neutralizing the

hydrosilicofluoric acid containing no more than 0.1 percent diphosphorous pentoxide, with aluminum hydroxide at a temperature of 90-95 degrees C and a slight surplus of acid.

The moist silicium dioxide, which contains a certain percentage of aluminum fluoride, could be best used in the manufacturing of special brands of cement.

According to the 1980 technological regulation on building an installation with an approximate capacity for 5,500 tons of aluminum fluoride, operating on the basis of imported aluminum hydroxide and local hydrosilicofluoric acid, capital investments totaling 2.4 million leva would be required and the annual profit would equal 407,000 leva.

Cryolite and Active Silicium Dioxide Production

A method was developed for the production of cryolite, based on the hydrolysis of ammonia with sodium silicofluoride at a temperature of 25-30 degrees C. The resulting mixed solutions of ammonia and sodium fluoride in a molecular ratio of 2:1 and a concentration of about 30-40 grams per liter of fluorine react with the concentrated sodium aluminate solution. The precipitation of the cryolite takes place by mixing the two reacting solutions (at a temperature of 95-100 degrees C). The gaseous ammonia which separates is regenerated and, after cooling, returned for hydrolysis.

Pilot tests have indicated the possibility of obtaining cryolite suited for the aluminum industry.

The method developed for obtaining cryolite enables us also to obtain active silicium dioxide (with a production of 4,500 tons per year of cryolite a total of 5,500 tons per year of silicium dioxide may be produced).

The studies which were made led to the development of suitable conditions for the production, washing and drying of silicium dioxide, which made possible its utilization as an active filler in the pharmaceutical and rubber industries. Semi-industrial tests indicate the possibility of using 500 tons per year of silicium dioxide as a toothpaste filler.

The technological and operational uses of silicium dioxide as a filler in rubber mixes (1,000 tons per year) was established in the course of semi-industrial experiments at the Chavdar DKZ in Svetovrachene, utilizing the installed plant equipment and on the basis of applied plant technologies (or recipes). The resulting physical and mechanical indicators meet the Bulgarian state standards and match the quality of imported products.

The economic results of the application of technologies for the production of cryolite and silicium dioxide indicate the following: cryolite production costs of 607 leva per ton, with a factory price of 670 leva per ton; silicium dioxide costs no more than 460 leva with a factory price of 650 leva per ton.

The cryolite production method was modified with the use of concentration solutions (60-70 grams per liter of fluorine) of ammonium-sodium fluoride and was used as a base in the development of technologies for the production of

cryolite and sodium fluoride needed in the electronics industry. The products obtained in the pilot installation were tested under factory conditions (at the ZMD [Magnetic Discs Plant] in Pazardzhik and the Transformers Plant in Sofia). The test of chemical processing of magnetic memory discs with sodium fluoride proved successful and the product indicators meet the plant's requirements. Good results were obtained in the cryolite tests as well.

The steady increase in the needs of our country for freon refrigeration agents and various types of fluoroplasts, which are currently imported from socialist and capitalist countries, called for the organization of their production in Bulgaria. A necessary prerequisite to this effect is the creation of a domestic industrial base for the production of hydrogen fluoride. In 1983 the TsIKhP conducted extensive studies of the possibility of obtaining hydrogen fluoride on the basis of waste fluorine-containing gases in EFK production.

As a result of the studies, an original cyclical method was developed for the production of synthetic calcium fluoride, which can be used instead of the scarce natural fluorite, which is a traditional raw material for the production of hydrogen fluoride and fluorine compounds.

The advantages of the method lie above all in the possibility of totally eliminating waste calcium sulfate in the conventional technology, lowering outlays of sulfuric acid and developing a totally different technology involving natural fluorite.

Comprehensive Processing of Local Nonbauxite Raw Materials

In the past 25 years the TsIKhP has done considerable scientific research on the use of local nonbauxite raw materials for the production of Al_2O_3 and aluminum salts.

Studies were made under laboratory and industrial conditions on baking kaolin and increasing the extraction of Al_2O_3 for the production of aluminum sulfate. In the course of the comprehensive processing of the sterol from the flotation of copper-molybdenum ore at the Medet enterprise, the high content of SiO_2, typical of Medet sterol, was determined, which makes it unsuitable for direct baking with limestone. This requires its chemical enrichment with KOH, based on the method developed by Academician Manvelyan. The content of Al_2O_3 in the undesolved residue is increased from 16-17 to 23-25 percent.

The conditions for baking the enriched product with limestone and leaching of the product, in the course of which 86-87 percent of Al_2O_3 and 78 percent of K_2O can be extracted, have been studied.

Conditions for the regeneration of alkalis from m-silicate and carbonate solutions, leading to the production of $CaCO_3$, have been determined. Semi-industrial experiments were conducted in Yerevan on the basis of laboratory studies.

The main shortcoming of this technological system is that significant quantities of sodium and calcium m-silicate are obtained, which are used in our country in insignificant amounts only.

A new complex method for the production of Al_2O_3, H_2SO_4 and a raw material for the cement industry was developed which allows the processing of the Medet waste.

The method is based on baking chemically enriched concentrate with phosphogypsum. This enables us to use the large amounts of phosphogypsum waste and achieve a high extraction of Al_2O_3 and alkalis. Difficulties arise in connection with the regeneration of the alkalis needed for enriching the sterol.

Studies of the method of baking with limestone were made relative to the use of bulgarites--alkali alumosilicates with a relatively high content of useful components (Al_2O_3, K_2O, Na_2O--30 percent). Under optimal conditions the level of extraction was Al_2O_3 over 78 percent; K_2O over 90 percent and Na_2O--70 percent.

A new technological system for obtaining self-powdering cake has been suggested, involving the preliminary separation of alkaline oxides (their content in bulgarites is 12-13 percent). This method ensures the high extraction of alkalis and aluminum.

Interesting studies have been made on the use of phosphogypsum baked with kaolin with simultaneous self-dusting of the cake. Optimal conditions and additives for baking the batch were defined. The influence of P_2 and O_5 and SO_3 indicate on the level of self-dusting and the degree of extraction of Al_2O_3 from it was determined.

Laboratory studies were made on the use of clays and argillites from the deposit at Zhablyano village for the production of Al_2O_3 by baking limestone based on the Grzhimek and the nitrogen-acidic method. The rate of extraction was 88.6 percent with the first, and 77.8 percent with the second method.

In order to settle the question of the use of potassium carbonate with mixtures of K_2SO_4, KOH, KCl and Al_2O_3 from which large volumes are expected to be produced in processing bulgarites through the baking method, the conversion of phosphogypsum with potassium carbonate was studied. It was established that such mixtures do not affect the degree of conversion.

Preliminary studies were conducted between 1981 and 1983 on the processing of clays from the seam above the coal at the Troyanovo 3 Mine at the Maritsa-Iztok SMEK [Economic Mining and Power Combine] of the sulfide and sulfite methods. Base aluminum sulfite (OAS) was obtained; its hydrothermal or thermal decomposition yielded aluminum hydroxide with a content of about 50 percent Al_2O_3 and raw Al_2O_3 with a content of 68-69 percent of Al_2O_3.

Crystal aluminum sulfate was obtained in decomposing OAS with sulfuric acid, consistent with Bulgarian State Standard 1841-78 for brands A and B.

The sulfite method is based on the two-stage alkalization of clays from the grey-black stratum above the coal seam, containing 22-24 percent Al_2O_3 and 5-6 percent Fe_2O_3. The method of treatment with hydrolysis in the presence of

minimal quantities of a catalyst was applied in order to separate the Fe_2O_3 contained in aluminum sulfate solutions. Crystalized aluminum sulfate was separated from the solutions, meeting the stipulations of Bulgarian State Standard Brands A and B, which meets the needs of the cellulose-paper industry.

The technical-economic specifications formulated for the production of 20,000 tons of aluminum sulfate indicate that savings will exceed 1 million leva.

The studies of bulgarites conducted during that period were aimed at determining the possibility of their use as a complex raw material in the production of potassium fertilizers (especially double fertilizer--potassium nitrate) in the course of the production of sodium and aluminum salts.

On the basis of the experience of some other countries and authors and, particularly, the specific composition of the raw material, a new variant is offered for a wet alkali processing system which will yield potassium nitrate, sodium sulfate (nitrate), calcium metasilicate and aluminum hydroxide.

Technical-economic computations show that with a volume of output of 5,000 tons per year for KNO_3, 8,000 tons per year of $Al(OH)_3$, 8,000 per year of Na_2SO_4 and 20,000 tons per year of $CaSiO_3$, overall economic benefits in excess of 2 million leva are expected.

The developed problems on the utilization of local nonbauxite aluminum-containing raw materials are of prime importance to our country, for which reason studies along that line should be continued until their industrial development has been organized.

Comprehensive Processing of Manganese-Containing Bulgarian Raw Materials

In 1958 the Inorganic Chemical Technology Section of the Chemical Industry Area of the TsIKhp set up a group on problems of the production of manganese salts based on local raw materials. Because of the low content of manganese in the ore of the manganese-carbonate deposit near Pripek village, Varna Okrug, ranging between 18 and 25 percent, the group focused its scientific work on obtaining highly pure manganese concentrate through chemical means. In 1963 the original technology which was developed was applied at the experimental-industrial installation of the SKhK in Dimitrovgrad. The resulting product--hydrohausmannite--is more than 99.5 percent pure. Subsequently, technologies were developed on this basis for the production of active MnO_2, $MnSO_4$ and $MnCO_3$ and manganese salts of reaction purity.

The same method was applied in developing a technology for processing manganese carbonate-hydrosilicate ore of the deposit near Obrochishte village, Tolbukhin Okrug.

The experience acquired in the chemical concentration of lean manganese ores was the base for resolving the problem of the comprehensive utilization of the useful components of Kremikovtsi ore. At the start of the scientific research on this problem (1959) attention was focused mainly on the possible extraction of other components, such as lead and copper.

A technological assignment was formulated in 1970, on the basis of which the decision was made to build an experimental industrial installation with a capacity for 10,000 tons per year at the L. Brezhnev SMK, which was commissioned by the end of 1980. The semi-industrial tests which were made proved that the choice of a hydrometalurgical technology, using nitric acid and/or nitrous gases, was the most expedient method for the comprehensive utilization of the Kremikovtsi ore.

Scientific research on problems of Kremikovtsi ore entered a new stage of development in 1981: maximal extraction of useful nonferrous components yielding high grade iron concentrate. The initial successes were achieved at the end of 1982. More than 90 percent of the iron was extracted with a 63-64 percent iron concentrate. More than 90-95 percent of the manganese and the nonferrous metal were extracted in the form of high grade concentrates. Furthermore, new ways were adopted for the regeneration of the oxide agent and its recycling in the technological process. Currently the scientific studies are focused on minimizing power outlays and optimizing technological conditions in the hydrometalurgical treatment of Kremikovtsi ore.

Throughout the entire period of its work, the group on manganese problems averaged a staff of five to six scientific workers and auxiliary personnel. The TsIKhP pioneered in our country the solution of problems of the utilization of manganese-containing local mineral raw materials.

New Plant Protection Chemicals

The use of herbicides is increasing on a global scale. New, improved and more efficient pesticides, less toxic to warm-blooded species, were introduced. Synthetic pyrethroids became increasingly popular among insecticides. The variety of system fungicides and compounds with local systemic action was broadened. The fast development of the industrial production of a combination of two or more active substances for simultaneous struggle against different diseases and expanding the range of herbicides was indicated.

Intensive efforts to synthesize new substances, caused by the appearance of insects and microorganisms resistant to the substances used has been a universal trend in the area of plant protection chemicals (KhSZR).

Following these global trends and in accordance with our specific conditions, we developed and created plant protection chemicals consistent with contemporary requirements.

The TsIKhP collective undertook to synthesize new organophosphoric active agents. The Chloracetophone-50 insecticide--the first Bulgarian original plant protection chemical--was applied at the end of 1983. The preparation is less toxic than substances currently used. It is planned that by 1990 its production will be increased to 2,000 tons per year. The USSR, Hungary, Romania and others have shown interest in the product.

The TsIKhP is also working intensely on developing new promising forms and formulas for plant protection chemicals. The biological activeness of some

morally obsolete preparations is enhanced through improvements. Combinations which showed highly encouraging results were developed on the basis of phosphamide, including preparations used against sugar beet and corn pests. A technology and an acaricide preparation based on dicophol--Tetranicide 2020--were developed jointly with the VNIIKhSZR [All-Union Scientific Research Institute of Chemicals Used for Plant Protection] in Moscow.

The chemical Triavap, for the struggle against the whitefly, developed jointly with the GDR, was applied in 1983. The purpose of additives was to improve the biological qualities of desiccants.

An expansion of areas planted in grain crops for human and livestock use is expected between 1990 and the year 2000. This will increase the need for insecticides. The increased need for acaricides is becoming apparent.

A reduction in the use of inorganic fungicides to a minimum is expected through the use of fungicides. The use of organic compounds will be increased, such as derivatives of dithiocarbamic acid, guanidine derivatives, pyridine, triasol preparations, benzimidazole, etc.

In the area of fungicides, the development of synthetic fungicides is planned with systemic or local systemic action. Particularly interesting from this point of view are triazole derivatives. The development of the production of systemic fungicides of the triazole variety will resolve the problem of fighting powdery mildew in wheat, which is our country's main crop.

The struggle against a number of diseases in fruit and vegetable crops will be waged successfully with the development of preparations from theallophane series.

The creation of chemicals for the preservation of stored agricultural produce is a particularly important trend in scientific research and application. Evaporation and rot losses in excess of 10 percent, depending on the variety, means of treatment, etc., will be lowered with the use of IKhP-300--a chemical used in the preservation of apples during preharvest treatment, developed by the TsIKhP. The same chemical is used in the development of other preparations for the preservation of potatoes, root crops, etc. The USSR, the GDR and Austria have shown an interest in this chemical.

In the area of herbicides,there have been promising developments on the creation of anilides with a view to ensuring the elimination of weeds in corn crops. Currently we are using derivatives of carbonic acids, derivatives of carbamide, amides, anilides and others.

Given the variety of weeds found among other basic farm crops--fruits, vegetables, vines, perennials, etc.--no single trend can be developed in herbicide production. Quite important in this respect are preparations based on gliphozat, phenmedipham, bentazone, pendimetalin, isoproturone, metoxurone, etc. In other words, the group of herbicides includes various chemical derivatives of carbamide, anilides, amides, carbamates and others.

Based on projections and the long-range program for mastering the production of low-volume chemicals by 1990, the main plant protection preparations will be produced locally. Specialized items will be imported from the socialist countries, and only a few preparations used for special purposes and specific crops will be imported from other countries.

Synthesis of Organic Semifinished Products

A program for the further improvement of the structure of the chemical industry through the extensive processing of basic raw materials, the extensive development of low-volume chemicals through 1990 and improving the Bulgarian foreign currency balance was approved by the Council of Ministers of the Bulgarian People's Republic in 1983.

This will lead to structural changes in the chemical industry. By 1990 the share of chemical raw materials will reach 28 percent and that of products of extensive processing of raw materials and low-volume chemicals, 72 percent.

Particular attention is paid in the program to mastering the production of organic semifinished products for dyes, plant protection, pharmaceutical and other items. Currently, our country imports most of them and, with few exceptions, the necessary semifinished products are imported for those synthesized in the country. The prices of such commodities have shown a steadily rising trend and procurement difficulties have increased.

Such organic semifinished products will be synthesized through the efficient utilization of obtained raw materials such as toluene, benzene and naphthalene. Their efficiency is manifested in the following areas:

Increased degree of processing of said raw materials and comprehensive utilization of the resulting products;

Mastering progressive and advanced technologies with reduced outlays of raw materials, materials, fuels and energy;

Utilization of Byproducts and Waste

On the basis of the domestically available raw materials we mentioned, three sets for low-volume organic semifinished products, derivatives of toluene, benzene and naphthalene, will be produced in the country.

The basic process in obtaining organic toluene-derivative products is mononitration and the separation of the isomer compound. The largest application will be that of p-isomer, which could yield the following more important semifinished products through multiple-stage processing: 4-amenobenzoic acid (used in the pharmaceutical industry and the production of optical bleachers and acids and direct dyes), 4.4'-diaminostilbene-2.2'-disulfoacids (a semifinished product for optical bleaches and some nonbenzidine dyes) and cresidine (disperse, acid and direct dyes). The o-isomer is used in the production of 2-toluidine (a semifinished product for the production of metachlor--a plant protective chemical--and some dyes).

The production of benzene derivatives requires above all its chlorination into chlorbenzene. After nitration, mononitroderivatives are obtained and used in the production of a number of semifinished products through subsequent multiple-step treatment. Thus, for example, the following more important semifinished products may be obtained on the basis of 4-nitrochlorbenzene: 3.4-dichloraniline (used in some herbicides), 4-phenetidine (for pharmaceuticals and some dyes), 4-anisidine (for cation dyes and organic pigments), 4-nitroaniline-2-sulfonic acid (for some acid dyes) and others. The following may be produced on the basis of 2-nitrochlorbenzene:2-chloraniline (for some organic pigments), 1.2-phenilendiamine (for some herbicides--methyltopsine, benomil) and 2-anisidine (for metal-complex dyes and pigments).

Through nitration to 2.4 dinitrochlorbenzene, the following may be produced from chlorbenzene: 2.4-dinitroaniline (for pigments) and 2.4 dinitrophenol (for acid, metal containing an active dye).

The production of highly pure naphaline is a prerequisite for mastering the production of an entire range of naphalinsulfonic acids and their derivatives, which are semifinished products for the manufacturing of dyes.

A wide range of products for a variety of uses may be obtained through basic technological organic synthesis. We have acquired a certain amount of production and engineering experience in mastering the number of such processes involving the use of low-volume chemicals, such as nitrobenzene, aniline, phthalic anhydryde, acetoncyanhydrine and H-acids.

In order to master the production of semfinished items on a high engineering level and at an accelerated pace, the efforts of the scientific potential must be concentrated on developing and advancing the basic processes related to the synthesis of such semifinished products. This applies to problems of the efficient separation of isomer mixtures obtained in toluene and chlorbenzene nitration.

In the hydrogenation of nitrogen derivatives to the level of the respective amines, in addition to traditional methods, research is necessary in modeling the processes under softer conditions, as well as the use of catalysts. Improving the sulfonation and nitration processes is an extensive area of work. This involves finding suitable technological and equipment solutions for sulfonation in a liquid gas medium and nitration in organic solvents. This would eliminate the shortcomings in these two processes: large surpluses of sulfuric and nitric acid.

Developing an efficient technology for the chlorination of benzene is a global problem. This means the utilization of the large quantities of residual hydrochloric acid and developing better methods for the introduction of chlorine in the benzene nucleus. Another problem related to the synthesis of organic semifinished products is developing efficient technologies for the production of highly pure naphthaline and naphthalinesulfonic acids synthesized from it. The large quantities of highly polluted residual waters from the production of the latter is the main shortcoming of existing technologies.

In addition to a scientific-engineering potential, an efficient system for coordinating various activities is needed in order to resolve such problems and achieve results equaling the best worldwide achievements.

Synthetic Dyes

Scientific research and application activities in the area of synthetic dyes were undertaken from the moment the TsIKhP was founded. Problems directly related to production activities, on which the collective of the dyes laboratory is working, may be classified in the following five areas:

1. Improving technologies in existing production facilities:

From the very beginning, the studies conducted by the dyes laboratory were directly concentrated on improving the technology for production of the following dyes: direct black 3; Prussian blue RL; the semifinished product 4.4'-dinitrostilbene-2.2'-disulfonic acid. This year, as a result of the intensification of the technology for the production of acid chromium black C dye, the production capacity of the installation was expanded by a factor of 1.8, accompanied by savings in electric power, fuel and labor.

The technologies which were developed for the production of such dyes in non-pulverizing commercial form are of great ecological significance.

2. Development of technologies for synthesizing new brands of synthetic dyes:

Studies were made and technologies developed for the synthesis and dispersion of four brands of dispersion dyes (yellow, orange, red and blue) for the coloring of polyamide, polyacrylonitrile and polyester.

Work in the field of organic pigments is being done in two areas:

Azo pigments: technologies were developed for synthesizing azo pigments in the yellow-red color range and a finishing surface processing method was developed for obtaining a marketable product. Such pigments are used in the lacquer and rubber industries, textile printing, emulsion dyes and viscose in bulk. A full color range of pigment pastes and corresponding bonding agents was developed for textile printing;

Phthalocyanic pigments: technologies were developed and semi-industrial tests conducted for synthesizing raw phthalocyanic pigment in an organic solvent and, on its basis, for obtaining a variety of crystal modifications: alpha, beta, and delta-unstable and beta-stable; and for a direct blue light-resistent dye.

3. Basic developments in optical bleaches:

Pyrazoline derivatives: as a result of the basic research conducted by the dyes laboratory on synthesis, properties and application of derivative compounds of 1.3-diphenyl-2-pyrazoline, technologies were developed and a number of optical bleaches and semifinished products for their synthesis were

applied in industry. The developed variety of optical bleaches includes some commercial brands used in a variety of areas, such as:

Belotex BK: for polyacrilonitril fibers in bulk, polystyrene, etc.;

Belotex A: for textiles made of acetate, polyamide or polyacrilonitril fibers, natural silk, wool and leather goods;

Belotex SA: for soaps;

Belotex AV: for polyamide in bulk;

Belotex SD: as an additive to neutral detergents containing essentially nonionogenic surface-active substances;

Belotex KM: for surface-active chemicals in bulk.

Developments in the area of pyrazoline optical bleaches are protected with five authorship certificates. Some of the trademarks are for previously undescribed compounds; others are original brands not produced in other countries;

Derivatives of bis-triazinylaminostilbene: TsIKhP activities in the area of stilbene optical bleaches are concentrated on obtaining products used especially as additives to detergents. Technologies were developed for the production of Belotex PAD and Belotex KD; the method used to synthesize them is protected with an authorship certificate. The production of the new brands of optical bleaches meets the full requirements of the producers of washing detergents in the country.

4. Formulation of forecasts, concepts and long-range programs for the development of the sector.

5. Technological and technical-economic studies of the production process and technical assignments relative to reconstruction and modernization.

Currently the collective working in the area of synthetic dyes is concentrating its activities above all on the development and application of synthesizing technologies and expanding the variety of existing ones, as follows:

Developing 1:2 methyl containing dyes for polyamide fibers and hides and some semifinished products for them, improving existing technologies, etc.;

Developing technologies for synthesizing active monochlortriazine dyes for printing and dying of materials made of celluose on a continuous basis;

Expanding the variety of acid leather dyes;

Increasing the variety of optical bleaches and improving their marketable forms.

The dyes laboratory of the TsIKhP will continue to concentrate its scientific research and application efforts on topical production problems related to improving technologies and quality and broadening the variety of dyes with a view to making our lives more beautiful.

High-Molecular Compounds and Auxiliary Materials for Them

The fast development of a relatively new branch of the chemical industry--the production of plastics, fibers, bonding materials, glues, etc.--is a major stage in the chemization of the national economy. Progress in the chemistry and technology of high-molecular compounds is directly related to the development of ever new synthetic materials and their application in various modern technological fields.

From the very beginning of its establishment, the Scientific Research Chemical Industry Institute (today's TsIKhP) undertook extensive work in the area of synthesizing high-molecular compounds for a variety of uses. Various projects are under way in the areas of polymerization and polycondensation of phenol-formaldehyde, furane, epoxy and polyester resins, polyvinylchloride, polyformaldehyde, polyvinyl alcohol, etc.

At the beginning of the 1960s synthetic resins, such as phenolformaldehydes, furane, polyurethane or their copolycondensates, found extensive application in worldwide manufacturing of sand mold mixtures for metal casting as bonding agents. On the one hand, this was dictated by the need to replace the vegetal oils and starch products used for this purpose and, on the other, by the steadily increasing requirements concerning the quality of castings.

The methods used in manufacturing molding mixtures with synthetic bonding agents are among the most effective: they reduce the time of hardening the casting molds and cores, improve their firmness and increase labor productivity by a factor of 2-3. Their use enables us to reach high casting precision, lowers labor outlays for the mechanical processing of the castings and improves their quality.

The synthetic bonding agents most frequently used in casting are cold-hardening furane resins. They meet best most of the requirements of synthetic bonding agents.

In accordance with global trends, the use of furane resins in metal casting was initiated in our country in 1973-1974. The TsIKhP (at that time the Scientific Research Chemical Industry Institute) set up a collective of 10 members to study the possibility of developing technologies for production of bonding agents and other metal casting auxiliary materials. As a result of the scientific research conducted in 1974 at the Kristal LKhZ [Casting-Chemical Plant] in Velingrad, FFF-1--the first Bulgarian brand of furane resin was developed: a phenolformaldehyde oligomer modified with furfuryl alcohol.

A new brand of furane resin, FKFF-2, was applied in pig iron casting in 1976 (protected with an authorship certificate). It is distinguished by its higher thermal stability compared with the imported Oovfixfuk (Hungary) and Vitresit-s1 (Czechoslovakia), and requires a lesser use of furfuryl alcohol--35-40

percent as compared to 50 percent in familiar furane resins applied in pig iron casting.

Because of its good technological qualities, FKFF-2 is one of the most extensively used bonding substances in pig iron casting, and its use is steadily increasing. From 400 tons per year in 1976, its production rose to 1,800 tons per year in 1983. Benefits accrued to the national economy from the use of the furane resin FKFF-2 have totaled 2 million leva.

The steady growth of the machine-building industry calls for increasing the variety of furane resins in metal casting. The TsIKhP has undertaken the development of new brands of furane resins used in steel and thick pig iron castings where FKFF-2 is unusable.

As a result of scientific research conducted in 1984, new brands of furane resins with a low nitrogen content were developed and applied: FS-10, FS-20 and FS-30, with a nitrogen content not to exceed 1 percent, and FS-13 and FS-23, with a nitrogen content of no more than 3 percent. The former are used in steel and the latter in thick pig iron castings.

The newly developed brands are distinguished by their high binding capacity and exceptional thermal stability resulting from their high content of furfuryl alcohol (as high as 95 percent).

One of the trends in research for the development of new types of binders is improving their bonding capacity correspondingly reducing the content of resin in the mold. This has led to the development of furane binders modified with functional organic silanes. The following brands were applied in 1984: FS-101, FS-201, FS-301, FS-131, FS-231 and FKFF-2M (protected with authorship certificates), distinguished by their improved binding capacity. The resin content in the sand mixes was reduced by 30-40 percent (from 2-2.5 percent to 1.5-1.6 percent of bonding substance in the casting sand).

The economic benefits of the use of such varieties of furane resins will exceed 500,000 leva.

Along with furane resins, suitable catalysts were synthesized for purposes of their chemical (cold) hardening. In 1984 the Kristal LKhZ developed and applied a technology for the production of p-phenolsulfonic acid as a catalyst for the cold hardening of FKFF-2 furane resin.

The greater variety of metal casting resins has increased the variety of catalysts. Systems of catalysts for fast, medium and slow hardening of the base of xylolsulfonic or xylolphenolsulfonic acid were developed: K-1, K-2 and K-3. This way, consumers can quickly vary the speed of hardening in the production of cores and molds depending on temperature conditions and part dimensions.

The TsIKhP developed a composition for an antiscorching coating based on zirconium (protected with an authorship certificate), distinguished by its good coating quality and high thermal stability, to meet the requirements of the metal casting industry for antiscorching coating in the manufacturing of

casting cores using furane resins. It matches the quality of the most renowned brands such as the Mold Coat Zirconium paint (the British Foseko) and others.

Asbestos-asphalt fibers were developed for sealing metal casting cases, allowing a considerable degree of mechanization in production and a reduction in losses of cast metal.

In castings with a complex configuration, the casting cores are made by gluing together two or more components. Gluing is one of the methods used in restoring broken casting molds. The glues used in casting must meet strict requirements: high heat resistance and a high bonding capacity which can withstand pressure, stress and the bending forces which develop in pouring the liquid metal in the molds and in their transportation.

The TsIKhP and the Metal Casting and Casting Equipment Institute jointly developed a glue made of abundant local raw materials, replacing dextrin-based glues used so far, which had a number of shortcomings, such as worsened quality of castings, an extended and costlier technological process, etc. The production of such glue was mastered in 1982 at the Novozagorska Komuna DPP (State Production Enterprise) in Nova Zagora and is used in a number of foundries in the country. This development is protected with an authorship certificate.

Economic benefits from the application of auxiliary metal casting facilities total about 150,000 leva.

Based on the experience acquired in the production of polycondensation products and aromatic sulfonic acids, the collective developed and applied other products as well, unrelated to metal casting.

A technology for the production of Kationit-1 cation carbamideformaldehyde resin was developed and applied in 1982 (protected with an authorship certificate) and used in the production of waterproof cardboard for maritime haulage. This resin is characterized by its low content of free formaldehyde (under 0.2 percent).

Applying the experience acquired in the production of p-phenolsulfonic acid (a hardener for furane resins), a variant of this technology was developed for the production of phenolsulfonic acid with properties suitable for electrolytic tin-coating of steel sheets. The technology was applied in 1980. Currently 120 tons per year of phenolsulfonic acid are produced, with economic benefits of 33,000 leva and foreign exchange savings of about $100,000.

Phenolformaldehyde resins are another basic development of the TsIKhP in the production of synthesized resins.

Until 1974 our country produced no more than a few brands of phenolformaldehyde salts (FFS) which could not satisify the growing needs of the various industrial sectors. The FFS has drawn attention because of its reliability and favorable price-quality ratio and possibility of replacing some metals and other traditionally used materials. The progress made in

their processing--the pressure-casting method, which is superior to pressing --has stimulated the development of such resins.

The TsIKhP has undertaken the study, development and application of various pure and modified phenolformaldehyde resins in the following areas:

FFS for abrasive instruments;

FFS for bonding casting sand;

FFS for fractional items;

FFS for glues;

FFS with low free phenol content;

A hard resol anilinephenolformaldehyde;

Alkali-and acid-resistant resins for cold hardening used in fillers and stoppers.

Phenolformaldehyde resins are extensively used as binders in the production of abrasive tools. Unsaturated polyester and epoxy resins are used in the manufacturing of special-purpose abrasive instruments. This justifies their high price and the many technological features and difficulties involved in their production. FFS-based abrasive instruments are less sensitive to shock and side pressure. Their better tensile characteristics allow the disc to develop a greater velocity and productivity. That is why they are particularly suitable for coarse grinding and cutting. Their elasticity makes them exceptionally suitable for fine grinding and polishing. Three brands of novolak FFS were developed as substitutes for resins imported from capitalist countries for the needs of the D. Filipov ZAI (Abrasive Instruments Plant) in Berkovitsa: BASAD-1, BASAD-2 and BASAD-3, protected with authorship certificates. They are the products of polycondensation of phenolwith formaldehyde, with a catalytic system consisting of hydrochloric and organic acids. A modification of the phenolformaldehyde resin with epoxy was developed to increase the elasticity of the BASAD-3 binder.

Phenolformaldehyde resins are also used as a binder in plating casting sand used in the manufacturing of cores and molds for pig iron and steel casting. They must meet special requirements such as low viscosity, high hardening speed, high bonding capacity, etc. The needs of our metal casting industry are met by importing ready-made plating sand from the FRG, which is economically unsuitable, for we are using foreign currency to purchase quartz sand, with a 3-4 percent resin content. This has required the development of two FFS brands: NSGP for hot plating and NSTP for warm plating. They are manufactured at the P. Volov Chemical Plant. With the help of specialists from the Metal Casting and Casting Equipment Institute in Sofia, a technology was developed for the production of plating sand-resin mixtures based on the "hot" plating method, using local materials. Based on this technology, so far plating sands have been developed and produced for the metal casting industry at the Vesletsa ChLZ [Shell Foundry] in Vratsa, the Progress ChLZ in Stara

Zagora, the ChLK [Shell Casting Combine] in Ikhtiman and the Metalik TPK [Labor Production Cooperative] in Burgas. The shell casting technology has been applied and well received by many domestic foundries.

Another area in which the collective is doing successful work is the creation of FFS for friction materials (FSFI). It was applied at the D. Toshkov SKhK and the Kristal LKhZ [Casting Chemical Plant]. It is distinguished by its high degree of meshing and strong intermolecular interaction, which provides high mechanical strength, resistance to wear and thermal stability of brake linings. Along with the resin a prescription was developed for the production of brake lining (protected with an authorship certificate). The new composition is free from the shortcomings of the mixtures for brake lining based on the liquid or solid resol resins. Liquid resol resins require the drying of the mixture and expenditures of electric power, labor and time, whereas hard resins require preliminary pressing of the mixture, due to its great volume.

Brake linings obtained with FSFI, based on the new recipe, have high operational indicators: a friction coefficient of 0.45-0.55; and a linear wear of 0.09-0.15 millimeters per 2 hours.

They have been well received in our country and abroad--in Czechoslovakia, Hungary, Cuba, Vietnam, Romania and others. They yielded 220,000 leva in of economic benefits and 412,000 foreign currency leva in 1980; economic benefits in 1983 totaled 550,000 leva.

An adhesive for gluing nitriol rubber with metal in the process of vulcanizing (protected with an authorship certificate) was developed on the basis of phenolformaldehyde resin and oil-resistant butadiene-nitril rubber. This adhesive assures an exceptionally high strength of bonding nitril rubber with metal in the process of vulcanizing, equal to the most famous adhesives, such as Hemosil-220, Leuconat and Pergut S_{40} and S_{90}. The adhesive is produced at the Zebra SKKI.

A technology was developed for the production of novolak phenolformaldehyde resin with a content of free phenol of less than 0.1 percent (usually free phenol in resins ranges from 5-8 percent). This technology will be applied at the P. Volov KhZ.

Cold hardening binders based on FFS for alkali-and acid-resistant stoppers, which are strong, heat-, water- and acid-resistant and inexpensive, are used in construction.

In 1983 the TsIKhP undertook the development of special brands of phenolformaldehyde resins. A prescription and technology were developed for the production of the Phenolit-K acid resistant and Phenolit-U alkali resistant resins by modifying the phenolformaldehyde resin and the catalytic system for the cold hardening of developed resins. They will be applied at the Kristal LKhZ. The anticipated economic benefits will be about 500,000 leva and foreign exchange savings will amount to some 300,000 leva.

Success was achieved also in developing a technology for the production of a modifier for the rubber industry, on the basis of reorcinol and hexamethylenetetramin, which strengthens the adhesion of the rubber to the cord. This extends the useful life of the products several hundred percent. An installation for the production of this modifier will be designed.

The use of FFS in various industrial sectors will be continued. The TsIKhP will continue its efforts in this direction, concentrating on the development of resins for coated abrasives, plating casting sand for nonferrous metals, brake linings for heavy duty trucks, and plastic glass, superior to polyester plastic glass in terms of resistance to heat and fire, etc.

For the past 2 years the TsIKhP has been working on synthesizing chemically stable nonsaturated polyester resins, above all oxipropylated dian. This development is about to be applied. Currently the resins are imported from capitalist countries in limited quantities. In connection with the forthcoming increase in the production of fiberglass for systems functioning in aggressive media (pipes, reservoirs, etc.), the need for such type of polyester resins will increase substantially, reaching 200-250 tons in 1985, for which reason the need for domestic production becomes relevant.

One of the initial accomplishments of the institute in the area of polycondensation resins is the synthesis of epoxy resins. Based on developed technologies for three brands of epoxy resins and the raw materials for them--diphenolpropane and dichlorhydrin, a shop was commissioned at the Lakprom KhZ, with an initial capacity for 120 tons per year. The unsuitable equipment for the production of dichlorhydrin, however, required technological changes. The shop undertook the synthesis of resins based on epichlorhydrin imported from capitalist countries.

In the area of polymerizing resins, the work is concentrated mainly on the polymerization and copolymerization of vinyl monomers. A comprehensive program for the development of a process for suspension polymerization of vinylchloride for a reactor of 80 cubic meters and a productivity of $200^{t}/_{m3}$ was drafted on the basis of a quadripartite agreement, which was concluded in 1973, and a contract which was initialed by the GDR, Poland, the USSR and Bulgaria in 1974. In accordance with the program, together with the SKhK in Devnya, the TsIKhP engaged in scientific research and developed technical documentation for the following: "Study of the Possibility of Regulating Polymerization Speed," "Continuing Dosing of Vinylchloride" and "Developing Methods for Reducing the Forming of Deposits on the Reactor's Sides."

A technology for the production of three basic brands of polyvinyl alcohol was developed jointly with the KNIPI in Devnya in 1982 and 1983; a partially and totally hydrolized product for general purposes and a special brand of stabilizer for the suspension polymerization of vinylchloride. The production capacities needed by the country will be designed and built. The economic benefits will total 1 million leva.

The institute's future work will involve the development of acrylic and metacrylic polymers and oligomers for the needs of the light and chemical industries. Studies have been made of the suspension and emulsion

copolymerization of vinylchloride with methylmethacrylate, itaconic acid, vinylacetate and butylmethacrylate. Good results have been obtained. The technology for the production of polyformaldehyde is another interesting development. An original method was created for the polymerization of formaldehyde in its gaseous phase and specific equipment, protected with several authorship certificates. Because of the specific features of the polyformaldehyde obtained in its gaseous phase, the institute has developed a technology for its stabilization (blocking end hydroxil groups with acetylation and inhibition of thermal oxidation destruction). The technology was tested in a semi-industrial installation with a capacity for 50 tons per year and technological regulations were drafted for an installation with a capacity for 5,000 tons per year.

The development of the plastics processing industry in recent years led to a sharp increase in the consumption of chemical additives, such as heat stabilizers, antioxidants, light stabilizers, lubricants and others, the needs for which have been met exclusively through imports from socialist and capitalist countries. In order to eliminate our country's lag in the production of auxiliary materials for plastics, in 1979 the TsIKhP undertook the synthesizing of some additives.

The initial operations in this area involved technologies for the production of some heat stabilizers for polyvinylchloride of the metal salts type, such as lead stearate, diasic lead phthalate, calcium stearate, dibasic lead stearate, tribasic lead sulfate, etc. Most such products have been included in the program for the development of low-volume chemistry, to be completed in 1987.

Based on bilateral cooperation with the users, work is under way on the development of harmless stabilizers for polyvinylchloride. In connection with improving labor safety in industrial premises, in recent years both in our country and in many others the use of toxic lead and cadmium containing stabilizers has been restricted. This has called for developing nontoxic substitutes of equal heat stabilizing effectiveness. The purpose of the development is to create harmless heat stabilizers based on calcium-zinc carboxylates and synergetic additives. The new stabilizers will be produced in 1987.

Based on new global trends, the TsIKhP is also studying the synthesis of light stabilizers for polyolefines of the type of spatially hindered amines. They are distinguished by a substantially higher light-stabilizing effect compared with the currently extensively used derivatives of benzophenons and benzotriazoles, as well as available basic raw materials, such as acetone and ammonia.

New areas of application of synthetic resins were developed in the manufacturing of zippers. The A. Uzunov Plan has replaced the use of the polymer Rylsan, previously imported from France, used in the manufacturing of the lower blocking parts of zippers, with Bulgarian polycaproamide (savings of 59,000 leva). The developed technology for the production of fibers for zippers, based on polyethylenterephthalate, is another great success.

An original method and system were developed for the use technological waste in the production of polyamide fibers. According to the method, the residue is melted, filtrated, extracted and dried. The system makes it possible for the newly obtained granulate to be dyed in bulk, to acquire heat stability, etc. Savings of 250,000 leva will result from the use of this development at the SKhK in Vidin.

Auxiliary Agents

I. Auxiliary agents for the Production of Chemical Fibers and for the Textile Industry.

Auxiliary agents for the production of chemical fibers and the textile industry consist of a great variety of low-volume items, the amount and variety of which directly depend on the production and consumption of textile fibers.

The improvement of technological processes in the production of chemical fibers, textile processing and improvements is a decisive factor in the development of auxiliary agents. The development and mastery of new auxiliary agents upgrades efficiency and improves textile production. It creates conditions for the introduction of new technological processes and methods for upgrading the quality of textile goods.

The main tasks of the TsIKhP collective working on the development of auxiliary agents for the production of chemical fibers and in the textile industry over the past 5 years were the following: a source of auxiliary agents which ensure optimal textile permeability of the staples and the high quality of output; studies on the choice of semifinished products and possiblities of producing them; development of technologies for the production and application of auxiliary agents for ensuring the maximal utilization of local raw materials.

The study and selection of semifinished products for the production of auxiliary agents for the manufacturing of chemical staples and for the textile industry, including surface-active agents (PAV), oils and bonding substances revealed that about 40 percent of the semifinished products must be imported.

The TsIKhP is developing technologies for the production and application of the following basic groups of auxiliary agents:

1. Auxiliary agents introduced in the bulk of the fibers in their production;

Heat Stabilizer for Polyamide Fibers

In order to improve the thermal stability of the Vidlon-type polyamide fibers, used in the manufacturing of automobile tires, conveyor belts, reinforced polymer sheets, etc., the SKhK in Vidin developed and applied a heat stabilizer which is a copper complex of polyvalent alcohols. The heat stabilizer is highly effective and suitably compatible with the polymer. It has no adverse effect on the physical and mechanical properties of the fibers. It is used in synthesizing polycaproamide and allows the mechanized and

automated introduction of additives. This thermalstabilizing agent is original and protected with an authorship certificate, with economic benefits of 280,000 leva.

Viscose Fiber Modifiers

A technology was developed for the production and use of Vestabit--a modifier for improving the staple-forming ability of polynose fibers. This product is based on sulfated higher fatty acids and nonionogenic PAV. Industrial tests were made and the regular production of this chemical is to be undertaken. Modifiers will be developed in the future for staple viscose fibers and silk, including fiber-strengthening varieties.

Pigment Pastes for Bulk Dying

This set is not part of the list of textile auxiliary agents. It is developed as part of the group of auxiliary agents for the production of chemical staples, as the choice of dyes and PAV for their dispersion depends above all on the properties of the polymer and the conditions under which it is produced and turned into staple. Pigment pastes have been developed and applied for bulk dyeing of polyester and viscose fibers. The quality indicators of black dyeing pastes are entirely consistent with the requirements of technological processes: size of the mass, less than 1 micron; total compatibility with the polymer; no worsening effect on physical and mechanical properties of upper staples. These developments are original and protected with authorship certificates. The economic benefit of their application is 260,000 leva.

2. Preparation agents for artificial silks:

Thorough studies of new global trends and of available raw materials in the country led to the development of technologies for the production and application of spinning compounds of the Predinoli brand. They are based on Bulgarian white and ester oils with suitably chosen emulsifiers, antistatic agents and other additives; 80-90 percent of them consist of local raw materials. Semi-industrial tests were conducted for the production of polyamide silk--smooth and textured--and polyester smooth silk. The textile processing of the silk was studied. The results indicated that Predinoli are as good in terms of quality indicators as imported spinning compounds. Their production will begin in 1985.

KP-AS Spindle Oil

This oil is used in the finishing operation of artificial silks. It protects the fibers from mechanical damage, lowers friction in the parts of the machines for textile processing in shuttling, knitting, spooling and weaving and gives the silks the necessary antistatic properties.

The KP-AS spinning oil is based on white mineral oil and a specially selected composition of PAV with emulsifying and antistatic features. It is made of 100 percent local semifinished products. This is a new development protected with an authorship certificate.

This spindle oil is used at the L. Tadzher NPZ [Scientific Production Plant] and applied in the production of textured polyester silk at the D. Dimov SKhK and at the Sviloza SKhK in the manufacturing of viscose silk. Economic benefits from its application are 82,000 leva and 112,000 foreign exchange leva from exports to capitalist countries.

The product KP-AS was awarded a gold medal at the 39th International Samples Fair in Plovdiv for its high quality and excellent consumer features.

Technologies for spinning preparations for polyamide industrial silk and thin cables are being developed within the framework of the work on "Technologies for the Production and Application of Preparation Agents for Synthetic Silks."

A contract was initialed on this topic among the members of INTERKHIM and is being developed jointly with the BRV [sic] by the Verila SKBKh.

3. Preparation agents for chemical staples:

The TsIKhP has developed and is conducting experiments under industrial conditions of technologies for the production and application of color brightening compounds for Etoksin-brand polyacrylonitril fibers. They are protected with authorship certificates and their regular production will be undertaken.

The use of color-brightening compounds for polyester staples will be undertaken following the production of anion-active antistatic agents of the phosphate ester type in 1986.

4. Auxiliary agents for the textile industry:

The tasks of the TsIKhP collective are reduced to develop new auxiliary agents consistent with contemporary technologies for textile processing, which improve the quality of output and result in the conversion of raw materials, materials and energy with maximal utilization of local raw materials.

Technologies were developed and industrial tests were made in meeting the following textile auxiliary problems:

Sinterol NSV washing detergent, for washing goods made of wool, synthetic fibers and their mixtures. It is nonionogenic and is 100 percent based on local finished products. The washing effect is maximal and does not worsen the quality of the goods. It is protected with an authorship certificate;

A greasing agent for wool and wool mixed with synthetic fibers, based on high-grade oils and special additives. Its use lowers the amount of technological waste and does not hinder the dyeing of the fibers;

A sizer for synthetic fiber bases, using polyethylene oxide. The use of this sizer significantly lowers the amount of dust in working premises;

A color-brightening compound added in dyeing items made of polyacrylonitril staples. Its use reduces the length of processes and volume of residual waters, conserves energy and improves the testing of finished goods;

A color brightening agent for improving the textile processing of polyacrylonitril fibers after dyeing.

In accordance with the plans for the development of technical progress, the TsIKhP collective working in the area of auxiliary agents for the production of chemical fibers and the textile industry is concentrating on the application of new technologies, the effectiveness of which will be determined above all by the improved quality of the produced chemical staples and textiles.

II. Auxiliary Agents for Other Industrial Sectors

1. Auxiliary agents for construction:

Casing Lubricants

Several types of emulsion casing lubricants have been developed in which the oily base consists of mineral oils while the emulsifiers, which also provide a good separation of the concrete from the molds, are nonionogenic or else a combination of nonionogenic and anion-active products. In order to improve the antiadhesive qualities of the lubricants, additives are applied which reduce the use of fresh petroleum products. These compositions are protected with authorship certificates.

Depending on their composition, the casing lubricants are applied as 20-40 percent emulsions of the "water in oil" type, which the consumer makes by mixing the oil concentrate with water at room temperature.

Hydrophobic Agents

A compound has been developed for impregnating and protecting cultural monuments from atmospheric influences, known as IMPREGNOL SE (a solution of a higher fatty acid and alcoxylanes in an organic solvent), replacing the chemicals Baker 290L and Baker OH, used so far. Very good hydrophobic results were achieved for buildings and masonry. The economic benefits of the application of this chemical will total 177,000 leva with savings of 455,000 foreign exchange leva. The construction industry is showing great interest in IMPREGNOL SE in the hydrophobic treatment of construction materials and new buildings. Its application will multiply its benefits.

2. Auxiliary agents for metal processing:

FEROL ET Lubricating and Cooling Liquid

This liquid is used in grinding steel bearings and has been received well by the machine building industry. It consists of a 3-5 percent transparent emulsion with good lubricating, cooling, washing and protecting properties. It is a suitable substitute for liquids imported from capitalist countries for

the same purpose and is superior to them in a number of respects. Its good properties are the result of the successful combination of emulsifiers, mineral oils and grafts. It is produced at the Verila SKBKh.

Hardening Media

For the past few years the TsIKhP has been successfully developing a new trend in thermal processing media: hardening media based on water-soluble polymers. They have cooling properties ranging between those of water and mineral oils, with a 1-5 percent concentration of the active agent. Several compositions have been suggested, based on local raw materials: polyethylene oxide, polyethyleneglycoles and polyacrylates, which are undergoing industrial tests at machine building enterprises.

Seasoners for Plastic Fillers.

The filling of polymers is one of the basic methods for the production of polymer materials with predetermined technological and operational features. Our country has a significant variety of inorganic fillers: chalk, kaolin, calcium carbonate and others, for which reason the problem of their surface processing with a view to improving their compatibility with the polymer matrix and their increased use in plastics is both relevant and promising.

Studies were made of suitable surface-active agents for seasoning mineral powdered fillers for thermoplasts produced in the country: polyvinylchloride, polyethylene and polypropylene; new ones are being synthesized. Work is under way on a technology for the production of such agents and means for their application on the surface of various fillers.

The solution of this problem will yield considerable direct and increasing economic results. The use of filling compositions will broaden the raw material base of the country through additional amounts of polymers, avoiding the use of scarce petrochemical raw materials and energy. The production of filled polymers will be mastered for the manufacturing of construction materials of improved quality and utilization indicators.

TIB-82 Antiadhesive

This antiadhesive agent is a mixture of surface-active agents, polyglycoles and especially selected additives with multifunctional effect and stabilizers. It is used as a lubricant and an antiadhesive for polymer materials used in metal molds. It is applied in water solutions. This product is a substitute for silicon emulsions and some silicon oils used for the same purpose. This development is protected with an authorship certificate. It was introduced in 1982 and its economic benefits total 220,000 leva.

III. Raw Materials for the Production of Auxiliary Agents For Industry and Construction.

The raw material base for auxiliary agents for industry and construction includes a large number of substances; mineral and synthetic oils and surface-active agents have been used to a greater extent. Our country made a major

advance in the development of a number of sectors with the production of nonionogenic surface-active substances. Equally popular of late are hydroxil-containing bi-and polyfunctional oligomer products based on alpha-oxides of olefines (ethylene, propylene). They can be used either directly or as part of subsequent conversions through their functional groups. This group of chemicals includes the polyethyleneglycoles.

The TsIKhP developed and applied at the SKBKh a technology for the production of polyethyleneglycoles (PEG) with a 300-6,000 molecular mass. The synthesis is achieved by adding a certain amount of ethylene oxide to the starter system--water or glycol--in the presence of a catalyst. A study was made of the influence of various technological parameters (temperature, pressure, amount and type of catalyst, etc.), which influence the development of the process and the quality of the finished product. The specifications and the materials for the developed technology have been selected such as to avoid the additional bleaching of the products. The properties of the polyethyleneglycols are determined by their molecular mass. At room temperature they are viscous liquids (PEG-200 to 400) and wax-like substances with a molecular mass of up to 600. The high wetting property, good solubility in water, compatibility with various compounds, low toxicity and reacting capacity of the two end hydroxil groups make them suitable for use in a variety of fields: the cosmetic, pharmaceutical, rubber, plastic, metal processing, textile, household and other industries.

In the rubber industry, the PEG are used as components of lubricants and antiadhesives, which ensure proper lubrication in vulcanizing and give a good appearance to the products (shine, glitter, depth of color, etc.). The advantages of the PEG are the following: good compatibility with rubber, leaving no coating on the surface of the item, which hinders further processing, and easily washable with water. The liquid PEG and the water solutions of the solid PEG are suitable as lubricants in vulcanizing chambers and diaphragms used in tire manufacturing.

The PEG are widely used as plastifiers for ceramic, ferrite and cement products. They are a frequent component of detergents, although lacking detergent qualities. This is because the active component is intensified by the solvent ability of PEG, which has a beneficial influence on the skin, do not react to electrolytes, etc.

Because of their water solubility, lubricants containing such products can be rinsed off after metal processing; surfaces can be subsequently treated (painting, application of galvanic coats, etc.). This property was used in the development of a series of lubricating, cooling and grinding-abrasive compositions and other metal-processing materials based on PEG.

Polyglycols with a higher molecular mass are important as modifiers in the production of recirculated cellulose with high strength indicators. They improve the quality of the cellulose fiber, giving it an integral structure with a reduced tendency to swelling and increased strength in wetting and drying.

The use of PEG in other industrial areas is a problem on which TsIKhp specialists are working together with other scientific collectives in the country, related to engineering-application activities in their corresponding sectors.

Phosphate Esters

Phosphate esters are the product of the interaction of hydroxil-containing compounds--fatty alcohols, oxyethylene alcohols, alkylphenols, with various phosphatizing compounds--diphosphoric pentoxide, phosphoric oxichloride, and orthophosphoric acid.

A technology for the production of phosphate esters with thermal or purified extraction phosphoric acid was developed on the basis of bilateral cooperation with the VNIISV, USSR. It will be applied at the SBKh in 1986. An installation with a capacity for 1,350 tons per year will be built, which will meet the needs of our country and exports to the USSR.

A range of phosphate esters has been developed on the basis of non-ionogenic PAV produced domestically. Studies were made of their properties and fields of application depending on the length of the hydrocarbon chain and the degree of oxyethylation. Methods are being developed for the production of phosphate esters of higher and medium fatty alcohols and diphosphoric pendoxide; non-ionogenic phosphate esters will be developed in the future.

Phosphate esters are extensively applied in a number of industrial areas. They are among the most effective antistatic agents in the production and processing of chemical fibers. Particularly active antistatic agents are the phosphate esters of ethoxylized higher fatty alcohols with 3-6 mole ethylene oxide. The phosphate esters of ethoxylized alcohols and alkylfenols are used as dry cleaning boosters.

Some phosphate esters are efficient antistatic agents for synthetic resins. They may be used also as finishing agents for plastic fillers.

Phosphate esters are used as detergents, dispergators and wetting agents in the textile industry; in household and industrial detergents; in washing detergents for automatic washers, etc. Esters based on higher fatty alcohols C_{10}-C_{18} are used in the production of liquid and paste detergents; those based on C_4 are used as oxidizing cleaning agents in industry at home.

Because of their lower toxicity and insignificant irritation of the skin, the phosphate esters will be used in the production of shampoos and as emulsifiers in cosmetics.

Some phosphate ester salts of higher fatty alcohols are used in the leather industry. They prevent the diffusion of the fat in the leather and contribute to its softening.

Phosphate esters are the most widespread corrosion inhibitors. By forming a protective coating they effectively protect metals from the effect of acids, alkalies, hydrogen sulfide, oxygen, etc.

The use of phosphate esters as lubricants in cold metal-processing looks promising. Combined with polyglycols and other products, they show good antifriction and scuffing characteristics.

Status and Prospects of Biological Studies

The TsIKhP undertook biotechnological studies in 1965 as a result of a program jointly drafted with the BAN [Bulgarian Academy of Sciences] Microbiology Institute, financed by the DKNTP [State Committee for Science and Technical Progress], aimed at developing a technology for the production of animal feed protein through the microbiological conversion of carbohydrates.

A scientific research work style was developed in the course of the implementation of this program. The main specialists were selected and organizational structures were developed within the collective, which made possible the parallel implementation of assignments without the need to set up small collectives to work on individual problems. The researchers in the biotechnological section work in three basic areas: selection, taxonomy and biochemistry of microorganisms; bioengineering and biokinetics; chemical technology and physical-chemical processes. This structure preserves the administrative and creative integrity of the collective and allows the flexible transfer of specialists from one project to another.

The main creative task of the collective is the implementation of the national coordination programfor "Development of Technology for the Production of Industrial Monocellular Protein (PEP) from Methanol."

Bearing in mind the scarcity of feed protein in our country, the efforts are concentrated on developing a product whose quality would be superior to currently imported soybean cake.

A technology was developed for the production of PEP from methanol, characterized by good technical and economic indicators.

Comprehensive tests of the product in animal husbandry, involving more than 50 tons of it, dealt with its harmlessness and high quality. One kilogram of the substance can replace 2 kilograms of soybean cake.

Reaching optimal production capacity is a complex engineering task which requires careful wide-scale conversion, for which reason it will be resolved gradually.

Along with work on tasks included in the national program, the collective is working on the application of contemporary bioengineering methods for environmental protection. An original concept has been developed for intensive local biological water treatment (ILBOV) for three different processes: purification of highly polluted water from the production of phenolformaldehyde resins, octanol-butanol and phenol. The last two are used at the Neftokhim SK.

Substantial difficulties are encountered in developing the necessary apparatus for the processes. The creation of reliable biotechnological equipment exceeds the framework of TsIKhP activities. Microprocessor systems for controlling continuing processes and sensors for measuring important technological parameters are being developed in association with other collectives.

The TsIKhP is included in the catalogue of Bulgarian equipment, drafted by the Ministry of Machine Building and Electronics, with its three developed measuring instruments, two pumps and one continuing action mixer.

The TsIKhP is also studying problems related to the utilization of raw material waste such as, for example, milk whey, which must be biotechnologically processed. Currently an efficient method for this purpose is its use, after bioprocessing, in the production of ethyl alcohol, organic acids, etc.

The institute is studying possibilities of applying biological methods in cleaning industrial gases and coal. Some results have been achieved, the utilization of which will depend on changes in economic factors in the years to come.

In order to upgrade the efficiency and quality of scientific research, it is necessary to enlarge the research laboratories, acquire foreign exchange for updating research instruments and hire research personnel trained in this area.

The TsIKhP has specialized in the field of continuing biotechnological processes. It thus deals with a scientific area not developed by the other biotechnological units in the country.

Environmental Protection

Enrironmental protection holds a lasting and important place in the institute's activities. The NIIKhP set up a work group on the treatment of waste waters from chemical production as early as 1960.

The first successfully resolved problem was the treatment of waste waters from the production of dyes at the chemical plant in Kostenets. The technology which was developed, based on absorption with active carbon, was applied in 1964.

The group is helping to normalize the technological regimen and to organize the normal work of the treatment installation for waste water at the Yeast Plant in Razlog.

In 1975 the assignment was issued of designing a treatment station for waste water from the production of phosphoric and sulfuric acid at the Dimitrovgrad SKhK. The construction of this station is nearing completion.

Toward the end of 1976, the group in charge of treatment of waste waters merged with the section on chemical technology processes and apparatus. A

single environmental protection unit was organized and became a separate section within the new structure of the TsIKhP, as of 1980.

Within a short time the environmental protection section developed a number of processes for the protection of water and air basins from pollution with waste product from the chemical industry, the most important among which are the following:

1. Technology for the treatment of waste waters from the production of extraction phosphoric acid, with a view to their recycling.

A temporary technological solution has been found for the local treatment of waste waters to an extent which allows their recycling in industrial processes.

Neutralizing with whitewash was used in eliminating the basic pollutants: fluorine and phosphates, respectively to 20 milligrams per liter and under 5 milligrams per liter. This development reduces the use of fresh water by 90 percent and ends the pollution of natural water reservoirs. The experience of Soviet plants was used as well.

2. Technology for the treatment of waste waters from the production of epoxy resins.

This technology is used in the treatment of waste waters from the production of epoxy resins to a degree which allows their dumping into the city biological treatment station or their repeated use in industry with maximal regeneration of toluene and sodium chloride.

The technological process consists of the following basic steps: separation of the toluene as the upper stratum in alternatively operating separation vessels, with a 3-hour duration; neutralizing the saline water stratum and subsequent treatment with active carbon; evaporation of the treated waters in a two-chamber evaporation system; centrifugal treatment and drying of the separated sodium chloride. The resulting industrial salt meets industrial use specifications. The condensate which separates from the evaporation system is recirculated with the water used in basic production.

3. Treatment of waste waters from the production of rubber items, containing latex.

A technology was developed for the treatment of waste waters from the production of immersed and molded rubber goods. It is based on the coagulation of the latex with a residual acid pickle used as a granulating agent, filtration of the waters, neutralization of the filter with whitewash, adding a flocculant, precipitating suspended residues and decanting the treated water which is then channelled into a water reservoir. This technology is applied at the Lateks Plant.

4. Treatment of waste waters from the production of iron oxide pigments and H-acid.

A system and technology were developed for processing waste waters from the production of black and yellow iron oxide pigment and H-acid, with a view to recycling waste products in the main production process and preventing environmental pollution.

This development has introduced several substantial original changes in the technology of these products. The suggested technology puts an end to discarding polluted waste waters, lowers the consumption of fresh waters for industrial needs and achieves a wasteless technology.

5. Technology for ion-exchange extraction of zinc from the residual waters in viscose production.

The system is used for extracting zinc as zinc sulfate from the residual water of the Sviloza SKhK with a view to its recycling.

The technological process is as follows: extraction of the zinc with the help of ion-exchange resin KRZ and regeneration of the extracted zinc as zinc sulfate with a 15 percent sulfuric acid solution. The resulting product can be used in the thinning tub.

This technology will put an end to the pollution of the Danube River with zinc ions, which are toxic to the river flora and fauna, and will increase savings in the production of viscose fibers. Expected economic benefits will total 300,000 leva per year. The development of this technology in cooperation with the Sviloza SKhK will be completed in 1984.

6. Further treatment of waste waters beyond the biological station with artificial sorbents and coagulants.

On the basis of extensive laboratory studies and orientational technological and economic computations, basic technological systems were developed for the further purification of biologically treated waste waters from petrochemical production facilities, with a view to their recycling or release in natural water reservoirs.

The first system includes the preliminary filtration of the waters through a sand filter and adsorption with active carbons; the second involves coagulation and subsequent filtration.

7. Study of the utilization of waste materials in the chemical industry.

An extensive study was conducted in 1981-1982 and an "Analysis on The Utilization of Chemical Industry Waste" was drafted. This project was carried out within the framework of international cooperation among CEMA member countries. The analysis includes three basic parts:

Description of the current state of formation and utilization of waste;

Main trends in scientific research in resolving problems related to waste utilization;

Analysis and evaluation of the most promising and efficient solutions which yield high economic results under Bulgarian conditions.

This development is a valuable source of information and a base for systematically developing and resolving problems related to the utilization of chemical industry waste.

8. Tapping and utilizing powdered saltpeter and carbamide from residual air released by the granulation towers and evaporators--third level.

An efficient and original method was developed for the treatment of residual air from the granulation and dehydration of nitrogen fertilizers--ammonium saltpeter and carbamide. The tapping of powdered and water-soluble products is accomplished by washing the dusty air in an enclosed scrubber, combined with a moistened filter and sprayed with a hose. The filter is made of suitably combined filtering fibers and latticed separation layers.

The developed treatment technology ensures a high degree of tapping powdered residual product: 70 percent for the air from the granulation towers and more than 90 percent for the air from the evaporators, with low energy expenditures.

The concentration of the resulting solutions may be raised to the 40 percent level, thus ensuring the economically profitable utilization of the resulting product. An authorship certificate was granted for this development.

9. Denitration of production industrial nitric acid.

A method was developed to remove dissolved nitric oxides from the 45-50 percent industrial nitric acid. The finished acid, which is taken out of the absorbers and is saturated with nitric oxides, is fed at a temperature of 50-55 degrees centigrade into a distribution container in which some of the nitric acids are separated and the flow is stabilized and channeled to the desorption pipes with latticed contact systems.

The nitric oxides are desorbed in the pipes with the intensive stirring of the acid by a counterflow of air and returned to the absorbers for the producton of nitric acid.

This method has been applied at the SKhK in Stara Zagora and Dimitrovgrad. The concentration of nitric oxides in the acid in the second combine has been reduced by more than tenfold and is less than 0.01 percent.

This development has an ecological impact: the release of nitric oxides in the air in storing and processing nitric acid is eliminated. Annual economic benefits from its application in the two combines total 91,000 leva. It is rated as an invention.

10. Lowering the emission of nitric oxides in dissolving molybdenum core in the production of electric bulbs.

A compact three-stage absorption system has been designed for tapping and utilizing residual nitric oxides from dissolving molybdenum core in a mixture of sulfuric and nitric acids in the production of electric bulbs.

The 30 percent nitric acid which is obtained as a result of water absorption in the first two pipes is recycled in the basic technological process. The further treatment of the waste gases in a third pipe containing a solution of sodium base in water until alkali nitrite-nitrate solutions have been obtained, which are used without any additional processing in some chemical processes for the treatment of metal items. Ninety-eight percent of the nitric oxides are tapped.

This development is of ecological importance: it ends air pollution with nitric oxides in the area. The recycling of nitric oxides saves on nitric acid.

This system is being applied at the Svetlina SK in Sliven.

11. Absorption of residual nitric oxides with degassed nitric acid.

A method and equipment for tapping nitric oxides from residual gasses released by an installation for nitric acid, working under atmospheric pressure in oxidizing ammonia and average pressure (3-5 atmospheres) in absorption of nitric oxides have been developed.

The method is based on the absorption of low-oxidation (20-40 percent) and low concentration (0.2-0.4 percent volume) nitric oxides in degassed nitric acid with a 10-30 percent concentration under a pressure of 2-5 atmospheres at temperatures of 20-30 degrees centigrade and subsequent desorption of dissolved oxides in an air flow under atmospheric pressure and a temperature of 35-50 degrees centigrade. The desorbed nitric oxides are returned to the absorption cycle for the production of nitric acid and the degassed nitric acid is recycled in the absorber for the treatment of waste gasses.

This method ensures the tapping and utilization of 70 percent of residual nitric oxides; the operational expenditures are compensated by the additional output of nitric acid.

12. Treatment of suction air from styrene vapors.

A technology has been developed for the treatment of air polluted by styrene vapors, in two variants: catalytic oxidation of the styrene of oxidized catalysts, developed and produced in our country, and adsorption tapping of styrene vapors with active carbon.

The development has an ecological impact. Its purpose is to protect the air from pollution with styrene vapors in the production of fiberglass items and in other industrial processes related to the use of styrene and the release of styrene vapors in the environment.

13. Wet tapping of dust from waste gases from washing detergents.

An original technological system has been developed for the wet tapping of dust from residual gases released by the atomizing tower in the manufacturing of washing detergents. Conditions were developed for the prevention of the intensive formation of foam and the accumulation of solid matter in the treatment system. The tapped detergent is recycled. Some of the heat released by the waste gases is utilized.

This development has ecological results: It reduces air pollution in the area. At the same time, economic benefits are achieved from the additional production of washing detergents and the utilization of the heat energy.

This treatment technology will be applied at the Verila SKBKh. Planned economic benefits total 118,000 leva per year.

In the area of environmental protection, the TsIKhP will specialize in the following areas:

Improving existing technologies for the treatment of residual waters and upgrading the efficiency of existing treatment stations;

Developing methods and technological systems for the treatment of waste waters in newly designed production facilities;

Developing technological methods and systems for further treatment of residual waters for recirculation;

Developing and applying sorptions processes for treating or rendering harmless residual gases containing harmful substances;

Catalytic treatment of toxic organic vapors in industrial waste gases;

Removing the dust from waste gases.

Whenever possible and expedient, TsIKhP specialists develop and submit methods for the treatment of residual waters and gases. The extraction and utilization of the valuable components contained in industrial waste contribute to the partial or full recovery of environmental protection costs. In some cases significant economic benefits result. That is why the utilization of waste products and the conversion of technologies into low-waste or wasteless is a permanent and main trend in the institute's overall environmental protection activities.

Anticorrosion Protection

In order to resolve corrosion problems in the chemical industry, in 1979 the TsIKhP set up a "protective coating" unit which engages in scientific research and application activities in five main areas:

1. Development and application of technologies and equipment for the production of powdered polymer materials for protective coating.

2. Technologies and equipment for anticorrosion protection with protective coating made of anticorrosion and polymer materials.

3. Mastering the technology and installation for the production of pentaplas as a structural and protective material.

4. Development and application of technologies for the production of lacquers with a high dry residue and coating compounds with higher chemical resistance.

5. Methods for the study and control of corrosion in the chemical industry.

Some of the more significant developments and results of their application are the following:

1. More economical and durable materials were developed for protective coating, compared with traditional materials (liquid, lacquer and galvanic), based on resins and polymers produced domestically (epoxy, polyester, PVKh furane and phenolformaldehyde resins). They are used as anticorrosion coats in the chemical industry and electric insulation and protective coating in machine building, electronics, electrical engineering, transportation, construction and the home. Some of the materials (PVKh) are in regular production while the production of others will be undertaken at the chemical plant in Kostenets. Two of the materials are protected with authorship certificates. The planned economic benefits from the use of such materials exceeds 1.4 million leva and savings of 900,000 leva in capitalist currencies.

2. A technology has been developed for the production of hard epoxy materials for the electronics industry--a product replacing the imported Araldit B ("Cyba Gaygi").

This development covers the production method and composition of epoxy resin with a 900 molecular weight. The resin is applied in radio engineering and radio electronic equipment in the manufacturing of a variety of goods such as measuring transformers, through-type and support insulators, and impregnation lacquers for electrical insulation materials.

The method is protected with an authorship certificate. The production of the material was organized at the industrial shop of the Elprom IEP in Zemen. Savings in foreign currency total 367,000 foreign exchange leva.

3. Within the program of the Ministry of Chemical Industry on mastering the production of new protective materials from corrosion in the chemical industry, together with the NPSK [Scientific-Production Economic Combine] for construction polymers, the TsIKhP has undertaken to master the production of pentaplast based on a Soviet license.

Pentaplast is a chemically durable polymer, in a number of respects equal to Teflon. It is successfully used in anticorrosion equipment as a structural material, as a lining and protecting coat, and in the manufacturing of industrial goods and pipes, thus replacing stainless steel and scarce nonferrous metals and expensive rubber linings.

Based on Soviet technology, a pilot installation using Bulgarian raw materials is used to manufacture semi-industrial quantities of pentaplast. Industrial anticorrosion tests were made with the use of this material at the Devnya SKhK, confirming the reliability of this material.

We are planning to double the production of pentaplast in our country by 1987 at the NPSK for construction polymers in Elin Pelin. The expected economic benefits total 2 million leva.

4. Technologies are being developed and applied in the production of lacquer protective coating with high dry residue and coating compositions with increased chemical durability.

Chemically durable lacquers and bases and coating compositions (linings) have been developed on the basis of tars and furane and phenolformaldehyde resins with a low content of organic solvents (a dry residue in excess of 60) and increased chemical resistance. They are used as anticorrosive agents under hard working conditions (aggressive media, temperature and pressure) in the chemical, power and metallurgical industries and in industrial construction.

Their use in anticorrosion equipment extends the useful life of the protected installations, lowers the cost of repairs and saves on steel, nonferrous metals and organic solvents. It improves environmental and labor ecology.

Production on a regular basis of the anticorrosion lacquer EK-50 has been undertaken. It is used as protection from corrosion in the chemical industry (the SKhK in Vratsa, Stara Zagora and Devnya), in shipbuilding--in insulating ballast ship tanks; in hydrology--in replacing the torcrete lining of irrigation projects and systems; and in the Petrol DSO in insulating reservoirs in which petroleum products (gasoline, kerosene, etc.) are stored.

A multiplied benefit in excess of 500,000 leva is expected from the application of this material at the D. Toshkov SKhK.

Other materials as well will be applied in 1984 (epoxy furfurol earth, epoxy furane lacquer, phenolfurane lacquer, furane coating and epoxy phenol lacquer). Expected economic benefits will exceed 400,000 leva.

Use of Pulse Equipment and Technology

The problem of pulse equipment and technology arose in 1967. Extensive design and research led to the development of an electrohydrodynamic pulse generator, on the basis of which new pulse technologies for the cold-processing of substances at standard temperature were developed. Scientific research and development activities have focused on the study, designing, experimentation with, development and manufacturing of specific equipment and complementing items for technological systems used in processing products based on the pulse technology method and the industrial application of pulse equipment and technology in economic sectors.

The problems on which work is under way cover the following areas:

1. Chemical industry.

a. Development of catalytic systems and catalyst carriers;

b. Development of fillers for polymer materials;

c. Development of nutritive media for the microbiological industry;

d. Development of preparations against human gastrointestinal diseases.

2. Metallurgy and mineral resources.

a. Sorbents for water media;

b. Sorbents for non-water media;

c. Additives to the agglomeration batch with a view to improving indicators in the agglomeration process in ferrous and nonferrous metallurgy.

3. Power industry: bonding substances for briquettes from East Maritsa coal for purposes of improving their indicators.

4. Light industry: development of a mineral plastifier for household and electric porcelain items.

5. Agriculture: development of preparations for prevention and treatment in veterinary medicine.

Scientific research and application efforts have led to the following results:

1. A basic solution has been found to the problem of producing pulse-activated bentonite for water media. A specialized shop was built at the Rodopi NPK in Kurdzhali for pulse energizing of bentonite. The finished product is used by the Vinprom DSO and the Farmakhim TPO.

2. New technologies were developed and applied for the production of household and electric porcelain items made of local raw materials and a pulse-processed mineral plastifier. This has reduced technological waste and improved the quality indicators of finished goods.

3. The Rodopi NPK developed and applied a technology for the production of drilling bentonite.

4. The preparation Bulgarben-B, used as a preventive medication for newborn calves within the system of NAPS [National Agroindustrial Union], was developed on the basis of Bulgarian bentonite.

Control and Analysis in the Chemical Industry

The Chemical Industry Control and Analysis Section is actively involved in scientific research and engineering-application activities at the TsIKhP by providing systematic analyses and control of raw materials, products, semifinished products and waste from various organic and inorganic items.

The analytical studies of chemical products are conducted with modern equipment. Contemporary instrumental analysis methods are applied. Because of the varied activities of the section, in terms of nature and specifics, it has been separated into two subgroups, the first of which deals with instrumental analysis methods, and the second with analytical-arbitration activities of the institute.

Instrumental analysis methods:

A number of problems related to the analysis and control of chemicals in organic and inorganic production, resolved some 10 years ago with an unsatisfactory level of accuracy, are now being resolved with the use of contemporary instrumental physical methods characterized by high sensitivity, minimal duration of analysis and very good data duplication. The information obtained through classical analytical methods remains exceptionally useful and, in some cases, irreplaceable. However, it is insufficient in terms of explaining the characteristics and behavior of a number of chemical products. The section applies basic methods of instrumental analysis, paying particular attention to spectral methods in which the studied object is subjected to electromagnetic radiation at a specific frequency. The information obtained through spectral methods is related to the structure, composition and properties of the item studied.

The following methods are applied by the section:

Infrared spectroscopy;

Ultraviolet and visible spectroscopy;

Atomic absorption;

Spectroscopy of electron paramagnetic resonance;

X-ray diffractometry.

Methods for the separation of complex multicomponent mixtures, methods related to the study of processes in thermal processing of samples, the study of surfaces, determination of the granulometric structure of powders, etc., are extensively applied;

Gas chromatography (gas liquid chromatography);

Derivatography;

Electron microscopy;

Sedimentation analysis;

Analysis with ion-selective electrodes.

The available equipment for instrumental analysis largely contributes to shortening the "research-application" cycle and the obtained information is more accurate, reproduceable and reliable.

Over the past 2-3 years the following more important original methods were developed:

Spectrophotometric determination of the breakdown of polycaproamide based on molecular mass;

Identifying N-methylene-2.6-dialkylanilins with infrared spectroscopy;

Fast spectral methods for identifying organic pollutants in extraction H_3PO_4, residual $(NH_4)_2$, SO_4 and residual waters at the NKhK in Burgas and the chemical plant in Kostenets;

Quantitative determination of the content of phosphorus in phosphorus fertilizers with infrared spectroscopy;

Atomic-absorption identification of microelements in nutritive and culture media in industrial protein production;

Atomic-absorption identification of microelements in liquid fertilizers;

Atomic-absorption identification of sodium, potassium and nitrates following the autoclave treatment of bulgarites;

Atomic-absorption identification of microcomponents in catalysts;

Atomic-absorption identification of elements in magnezites and slags;

Identifying the existence of organic and inorganic free radicals with the help of EPR [electron paramagnetic resonance] spectroscopy;

Study of complex copper compounds with spectroscopy;

X-ray phase analysis of polycrystal samples;

Studies of the surface of sorbents with electron microscopy;

Studies of the structure of crystal samples with electron diffraction;

Electron-microscope determination of the purity of bacterial strains in the production of industrial protein;

Gas chromatographic methods for the analysis of polar and/or high-boiling compounds with the use of a bonded phase;

Gas chromatographic analysis of free volatile fatty acids in biological samples;

Separation, identification and quantitative gas chromatographic determination of components in a combined fraction of heavy pyrolysis resin, a residue of ethylene production at the Burgas NKhK;

Gas chromatographic identification of hydroxypropyl dian at the Verila SKBKh;

Gas chromatographic methods for the analysis of alkylated and substituted aniline derivatives at the G. Genov SKhK;

Determining the granulometric composition of inorganic products.

The equipment was purchased from leading companies in the area of instrument analysis: Karl Zeiss (GDR), Pi Unicam (England), Philips (Holland), Brucker (FRG) and Sartorius (Austria), most of which are serviced by Bulgarian specialists.

Analytical-Arbitration Activities

The section is authorized to conduct control arbitration analyses and to issue corresponding documents grading products mainly of inorganic origin.

The control-arbitration analyses and tests cover all indicators and technical stipulations included in the respective standardization documents: Bulgarian State Standards, CEMA Standards and Sectorial and Plant Standards.

In addition to analyses of products, based on standardization approved methods, analyses of developed original methods account for a considerable percentage of the work:

Analysis of phophorus and sulfates in biomass;

Analysis of sodium nitrate in the presence of sodium nitrite;

Identifying arsenic, selenium and copper in residual waters from the production of sulfuric acid;

Identifying chromium in chromium silicate;

Identifying carbamide in carbamide-phosphate.

The section is working on drafts of Bulgarian State Standards for active and industrial products, based on the state standardization plan.

A significant number of analytical methods, developed by the section, have been included in the Bulgarian State Standards, the CEMA Standards, Sectorial Standards and Technological Regulations, etc.

Rubber Industry Area

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[Introduction by Candidate of Technical Sciences Kiril Rakovski]

[Text] The rubber industry is a dynamically developing subsector which meets the basic requirements for industrial rubber goods (TKI) and air tires (PG) and provides for significant exports which compensate for imports of some low-quantity rubber items and tires.

Along with comprehensive Soviet aid provided by highly skilled specialists and scientific workers, TsIKhP developments deserve great credit for the substantial growth and accomplishments in the rubber industry.

The TsIKhP overall activities are concentrated on the development of our rubber industry which meets the needs of all sectors and subsectors in the national economy and, particularly, the accelerated development of machine building, for high quality TKI and PG.

Currently the Rubber Industry Area is the main center for scientific and applied research in this subsector. Its development, involving the participation of the servicing plants, ensures technical progress in the production of basic TKI in our country.

The institute is working both along the old lines for the production of hose, used to this day, and more modern ones with a continuing process in the production of coiling hose. Assembly lines will be developed for the production of high pressure hose reinforced with metal wire, also developed by the institute.

This development area is actively participating in the application of new raw materials and their periodical replacement. The fast development of recipes and technologies led to replacing natural rubber, which is a scarce, expensive and a strategic raw material, initially with Soviet nitrobutadiene rubber and, subsequently, butadienestyrene rubber.

The joint developments by the institute with plant collectives also involve the use of newer and improved rubbers: SKI-3, SKD, SKN, butylrubber, chloroprene rubber, EPSK and, recently, fluororubber and silicon rubber. A certain lag has developed in developing and mastering the production of polyurethane rubbers and thermoelastoplasts.

Mastering the production of the new type of rubber involves not only the use of new recipes but also developing and correcting existing technological processes and work systems and, in a number of cases, amending structures or developing new ones for items produced in the rubber industry area. This has contributed to reducing the overall use of natural rubber by some 20-25 percent, in the course of which the quality and operational resources of the items have been steadily improved. The developments of the institute and the plant technical departments have resulted in an even greater reduction in the use of natural rubber and, in some situations, its total elimination.

A great deal has also been accomplished in applying new and more efficient reinforcing materials and replacing older with improved new materials which prolong the useful life and improve the working qualities of industrial rubber items.

Structures and technologies for the utilization of economically and technically and operationally more efficient viscose-reinforcing textile materials for some rubber-textile items (belts, hoses) and in basic sizes of tires were developed. Replacing cotton with viscose-reinforcing material improved the quality and functional properties of rubber items.

Structural and technological developments made possible the application of polyamide-reinforcing materials (cords, fabrics, threads) and their mass application in tires, conveyor belts, hose and other reinforced rubber items.

Polyester-reinforcing materials and a limited number of steel strengtheners--namely metalcord in the breaker of radial tires--are used in the manufacturing of some items (hoses, belts, etc.).

Studies and developments will be made aimed at producing even more effective reinforcing materials (metal and glass fibers, strengtheners, etc.).

This area includes making studies and providing technological solutions involving a number of new raw materials and ingredients. Technologies have been developed involving the use of new imported adhesives (homosil leuconat) with new accelerating, anti-aging and anti-scorching agents aimed at improving and intensifying basic technological processes and increasing the functional resources of TKI and PG.

The collective has also engaged in basic developments and research aimed at replacing gas carbon black (canal, thermal, etc.) with new economically more advantageous "furnace carbon black" (PM-100, PM-75, PM-50, etc.).

In addition to basic technological studies and design developments, the institute is engaged in studies of a more general basic nature, although indirectly related to applied developments for which they provide a theoretical base. This involves extensive studies of the frame and structure of tires, which led to a number of structural improvements, the use of an improved structure of vulcanized products and the use of polyamide cord in tire manufacturing.

The extensive amount of basic research conducted with the IKK of the Bulgarian Academy of Sciences in the area of polymer and vulcanized rubber aging and stabilization was applied in developing protective groups of basic types of PG and TKI. This improved their quality and utilization.

The problem of meeting national economic requirements for air tires, which required the development of a large number of new dimensions of heavy-duty farming, electric car and passenger car tires, was resolved in its essential lines. This includes the accelerated development of heavy-duty tires 11.00-

20; 12.00-20; 10.00-18; and 12.00-18; agriculture: 12.00-38; 12.00-16; 8.25-15; and 7.5-16; electric cars: 18x7-8; passenger car tires 8.4-15, etc.

The structure of vulcanized rubber products was improved and new basic improved ones were developed.

The constructive use of polyamide cord in air tires substantially contributed to improving their quality and use.

The design for a new shop for rebuilding PG and the technology and structural decisions for the production of regenerated rubber involved the active participation of the rubber industry area. Work is being currently done together with the shop's collective to stabilize production quality, reduce defects and manufacture large-size rebuilt air tires.

The production of conveyor belts is one of the important high-volume products, developed with the help of the rubber industry area. The stages of its development include the conversion to synthetic reinforcing raw materials (essentially polyamides) on a new elastomer base, and the development of new types and varieties of wider conveyor belts, especially reinforced for the USSR, and antistatic and fireproof belts for the coal mining and other industries, with improved service life. Our country is already offering conveyor belts on the international market.

The production of various types, varieties and dimensions of fillers is also developing with the participation of this area. At its present development stage, the rubber industry is meeting the needs of the national economy, machine building in particular, for quality fillers. Technological and structural solutions have been found for the production of fillers based on EPSK used in construction, involving machines powered by ultra-high frequency current. Special fillers are being currently developed for a new elastomer base, including the use of furane rubber in the electrical engineering industry and marine diesel engines.

The production of solid tires, essentially being developed by the institute from the technological and structural viewpoint, is important in car manufacturing--an area in which our country has specialized. World standards have been attained in the development of solid tires with reduced wear losses. Work is being done to improve the operational qualities of solid tires. An important long-term task facing this production area is developing and mastering the production of solid tires with improved indicators, based on polyurethane elastomers.

A license was purchased from the Gates Company to ensure the fast solution of problems which developed in the production of V-shaped belts. Specialists in the rubber industry area participated in the practical application of this license, particularly in the use of local raw materials and the structural development of the technological equipment.

Considerable work has been done in the area of latex items. A number of immersible latex items and air-foam rubber (construction flooring) have been developed and are being produced. We are studying the purchasing and use of a

license based on the Talalay method for the production of improved and more efficient air-foam rubber and air-foam rubber items.

In recent years specialists in this area successfully developed and applied a series of roofing materials for sports stadiums and grounds.

We have also initiated the development of rubber coating for flotation equipment and lining with anticorrosion coats for chemical equipment, which can withstand the effect of a variety of highly aggressive media.

The development of the electronic industry faces the rubber industry with a number of requirements in the development of rubber goods and parts consistent with the specific requirements of the electronic industry. Successful work is being done in this area by meeting various orders for electronic production.

Essentially, industrial rubber goods are being produced and marketed on the basis of approved standards and norms with the active participation of specialists and scientific workers in the area of their development and approval.

Over the past 3 years alone 29 authorship certificates have been issued and a number of articles published in a variety of periodicals. The scientific associates are regularly participating in conferences, symposiums and other scientific and technical activities both at home and abroad.

The efforts in this area are concentrated on the solution of basic problems, such as:

Upgrading the reliability and durability of rubber goods;

Developing prescription designs and technologies for the manufacturing of industrial rubber goods for various economic sectors;

Developing of new technological processes and intensifying existing ones;

Seeking new raw materials and materials for TKI;

Conducting further studies on aging and stabilization processes;

Modifying vulcanized rubber and goods made of it, etc.

Guided by the decisions of the National Party Conference on Quality Problems, the collective in this area will dedicate its forces, skills and knowledge to the application of developed scientific and technical problems and the creation of new developments which will ensure the successful work of our national economy. [Contributed by Candidate of Technical Sciences Kiril Rakovski]

Rebuilding Air Tires

The development of scientific and technical progress in air tire production led to structural improvements of their frame--high strength and usefulness, greatly superior to the wear resistance of the tire tread. Its residual usefulness has been increased, thus increasing the disparity between it and the frame. Furthermore, as a result of new structural material, the share of the frame in the overall cost of the tire increased significantly. These trends led to intensive scientific research aimed at utilizing the residual usefulness and the cost of air tires discarded as a result of the wear of the tread. Several rebuilding methods were developed, such as Orbitread, Bandag, Pressuretread, etc., which lower the cost of rebuilt tires down to about 30-35 percent of new tires.

The high economic efficiency of such restoration determined its great national economic significance to our country. In accordance with world trends and development prospects, a tire rebuilding shop with an annual capacity for 330,000 units was added to the K Rusinov SKKI. The technology and design needed for its regular operation were developed by the collective of the Bicycle, Motorcycle and Rebuilt Tires Section. The technology based on the Orbitread method is on a modern scientific and technical level, using a high degree of mechanization and automation. Regular production of 13 sizes of rebuilt tires for passenger cars, panel trucks and trucks began with the application of this development in 1979 and significant economic results were achieved by saving on cord, rubber, carbon black, fuel and energy. A technology was also developed for the production of rubber compositions used in rebuilding tires at the new rubber mixing shop of the K. Rusinov SKKI.

As a result of the application of the new designs, technology and compositions, the running length of restored tires has reached 80 percent of that of new air tires.

The share of the frame in the overall cost increases with the increase in size and number of plies in the tire. The economic effectiveness of rebuilding multiple-ply tires significantly exceeds the effectiveness of rebuilding smaller-sized tires. That is why increasing the variety of rebuilt large-sized and airplane tires is a worldwide trend. In our country, the usefulness of restoring such tires is determined also by the fact that we meet the need for them by importing them from socialist and capitalist countries. These trends and development prospects called for undertaking scientific research for the development of a technological line for rebuilding large-sized tires, which includes the production of vulcanizing chambers. Based on design and technology developed by the section, the regular production of large-sized 18.00-25 tires, used in the ore-mining industry, was mastered in 1982 and that of 21.3-24 and 23.1-26-sized tires for agricultural machinery, in 1983. Before the end of 1984 regular production will be undertaken of restored large-sized tires for road-building machinery in sizes 13.6/12-38 and 21.00-33.

A study was made of the trends and methods of rebuilding tires for agricultural aviation. Scientific research and application work was undertaken this year in developing structural and technological documentation

for rebuilding the most frequently used aviation tires in our country--800x260. With the application of this development our country will become one of the few countries in the world to restore such tires.

The energy crisis of the 1980s was the reason for the steady increase in demand for bicycle, motorcycle and motor scooter tires and increases in variety and improvements of their design and production technology and enhanced quality and durability. In order to meet such increased requirements, we undertook the building of a shop for the manufacturing of bicycle, motorcycle and motor scooter tires at the K. Rusinov SKKI, with an annual production capacity of 1.2 million tires and 1.8 million inner tubes. The Bicycle, Motorcycle and Restored Tires Section studied the trends and methods used in the production of such tires and developed technologies and structures for the production of bicycle, motorcycle and motor scooter tires in 27 sizes, the regular production of which will be undertaken at the new shop under construction. Production of the basic sizes will be mastered in 1984.

The section's scientific research is of primarily applied nature. Some 70 percent of the developed topics are used in providing scientific and technical services to the K. Rusinov SKKI. The main trends in the activities of the specialists in the section are improving the functional qualities and expanding the variety of produced items and upgrading labor productivity and production quality by creating and undertaking the regular production of new progressive items equal to world standards.

The research and application activities of the Bicycle, Motorcycle and Rebuilt Tires Section are also aimed at developing items and technologies which would conserve raw materials, materials, fuels and energy. A technology was developed for the introduction of rubber runners in the protective lining of rebuilt tires. This development will enable us to use some of the rubber waste and reduce the cost of elastomer compositions used in rebuilding air tires.

Five of the 18 authorship certificates awarded the section were based on the utilization of rubber and other waste products of the chemical industry.

The lengthy scientific research activities of the section and prospects for scientific and technical progress in the production of bicycle, motorcycle, motor scooter and rebuilt tires offer prerequisites for resolving new and important problems in upgrading the scientific and technical standard of the items and the technologies used in their production.

Destruction and Stabilization of Elastomers and Vulcanizers

During the past 10-15 years the stabilization of elastomers and vulcanizers has been a particular topical problem. Its significance and the interest shown by researchers and producers in it are determined by the high rate of increase in the production and processing of polymer materials and the stricter requirements concerning the quality of items based on them. Rubber goods are exposed to a variety of adverse external influences (oxygen, heat, ozone, ultraviolet radiation, mechanical action, etc.), which result in

significant losses in functional adequacy and shorten preservation and utilization time.

The reliable protection of vulcanizers may be achieved only with good knowledge of the mechanism of the destructive processes which occur and the proper choice of inhibiting systems (based on the nature of the elastomer and the conditions of work of the vulcanizer). For this reason, along with extensive theoretical studies of destructive processes, today's science and practice pay great attention to the synthesis of new and effective stabilizers and to improving the quality of conventional inhibitors used.

The principal means of stabilizing polymer materials, including elastomers and rubber goods, are the following:

Introduction of chemical additives--inhibitors which operate as active deactivators of the products of oxidizing destruction;

Introduction of physical antiaging agents (chemical by neutral compounds) such as microcrystal waxes, paraffins, etc.;

Chemical modification of the elastomer molecule with a view to lowering its ability to react to oxidizers, introduction of stabilizing groups, etc.;

Physical modification of vulcanizers with the introduction of chemically inert agents and coats resistant to the influence of destructive factors, such as ozone, oxygen, solar radiation, etc.

The topical nature of the problem, the complexity and variety of means of reaching efficient solutions and the unsatisfactory degree of stabilization in Bulgarian-made rubber goods called for the development of intensive scientific research and application efforts. In 1979 the Ministry of Chemical Industry assigned to the Rubber Industry Area of the TsIKhP the formulation of a long-term coordination program for "Study of Destruction Processes in Elastomers and Vulcanizers and Development of Means and Methods for Their Stabilization." The main targets of the program were the following:

1. Determining the mechanism of oxidizing and other destructive processes in polymers.

2. Inhibiting destructive processes and developing new stabilizer systems.

3. Creating (synthesizing) items and vulcanizers of increased resistance in use and preservation.

4. Developing a technology for synthesizing familiar and new stabilizers and studying the possibility of organizing their production within the Ministry of Chemical Industry system.

5. Classifying inhibitors and recommended stabilizing systems.

In order to ensure the successful solution of these problems, the TsIKhP integrated its efforts with those of the Kinetics and Catalyst Section of the

BAN (today the IKK). The joint collective of specialists has been conducting extensive research during the past 3-4 years.

This has led to the description of a number of specific behavioral features of the various types of stabilizers and their substitute derivatives (p-phenylendiamines, methylene and thiobisphenoles, chinolines and phosphites) in oxidizing reactions with oxygen and ozone. Certain patterns and differences were determined in the stabilizing effect of antioxidants and anticorrosive agents in the course of the oxidizing process in liquid and solid phases (vulcanizer). The basic kinetic parameters characterizing the various stabilizers, used separately or in combinations, were determined, with a view to studying the energy results of their interaction. Studies were made of some basic physical parameters of the stabilizers, such as volatility, diffusion ability and resistance to flushing with fluids in various elastomer compositions. These studies became the base for rating stabilizers and their synergistic systems considered most suitable in rubber production.

The optimal doses of stabilizing systems for items with different technical uses were determined. Four stabilizing systems are protected with authorship certificates.

Fast methods for assessing the effectiveness of the protective action of stabilizing systems, antioxidants and anticorrosion agents were developed.

Application work based on the coordination program covers the production of air tires, conveyor belts and hose. The stabilizing system is N-phenyl-N'-Isopropyl-p-phenylendiamines (2.2.4-trimethyl-1.2-dihydroquinoline) superior to the others in terms of efficiency, technology and utilization possibilities.

New elastomer compositions were developed for treads and sides with a significantly lower content of natural rubber, also protected with authorship certificates.

The use of the developed stabilizing systems in the composition of sides and treads for light and heavy air tires at the SKhK-ZPG in Vidin and for treads and frames of conveyor belts and inner and outer walls of hose at the K. Rusinov SKKI, proved that the mixtures and finished items retain their physical and mechanical properties considerably longer under ozone (double the time), heat and atmospheric aging compared to those currently produced.

Thus, for example, air tires have shown a drastically increased resistance to aging, as follows:

Durability under warehouse conditions has increased from 4.5 to 6.2 years, i.e., by 35 percent (GOST [Soviet State Standard] 9033-74);

The ozone resistance (the period preceding the appearance of surface cracks) with an ozone concentration of 6ppm, 30 degree centigrade temperature and a 20 percent static deformation increases from 30 to 100 minutes, i.e., by 230 percent (BDS [Bulgarian Standard] 8851-71);

Ozone resistance (period preceding the destruction of the vulcanizer) in the previously mentioned conditions increases from 300 to 800 minutes (BDS 8851-71), i.e., by 180 percent;

The time of destruction in atmospheric aging is extended from 9 to more than 18 months, i.e., by more than 100 percent (GOST 11140-65);

Instrument and field tests have indicated 20 percent higher results in the overall functional suitability and use of air tires compared to those produced so far;

Compared with the standard use of 3,900 kilometers, lightweight 165R-13 air tires achieve an average run of 54,000-55,000 kilometers.

As a result of the use of optimal stabilizing systems in rubber compositions, used in oil-resistant, water and air hose and conveyor belts, resistance to aging improves sharply.

The hose produced on the basis of TsIKhP technology, with accelerated testing, indicate the following ozone resistance:

Low-resistance hose: more than 20 hours as compared to 3.5 hours of hose in regular production at the K. Rusinov SKKI, i.e., a 470 percent improvement;

Water and air hose: 71.5 hours as compared to 18 hours of regularly produced hose, i.e., a 450 percent improvement.

Resistance to heat aging and ozone resistance of the compositions of conveyors belts have been improved as follows:

Changes in the relative stretching after heat aging (at 70 degrees centigrade, 7 days) is 19 percent, compared to 29 percent in regularly produced ones, i.e., a more than 50 percent improvement;

Ozone resistance (period until the appearance of the first cracks) is increased from 55 to 90 minutes, i.e., by more than 60 percent.

The extended time of use and preservation of the items produced on the basis of TsIKhP technology means, in practical terms, economizing on new items in proportion to the lengthened time span. As a result of the multiplied use of this development, material, energy and labor savings exceed 10 million leva per year. In the private sector alone, the consumption of air tires 165R-13 with a 20 percent increased run, will result in savings in excess of 2.5 million leva.

Currently the collective faces new tasks. They are related to the increased study of the mechanisms of the destruction-stabilization process, which takes place in the vulcanizer, which is a complex polymer heterogenous system. On the other hand, the new tasks include the study and specialized use of new chemical and physical stabilizers in rubber goods for various uses.

The comprehensive solution of the problem of effective protection of rubber goods also requires meeting the needs of our rubber processing industry with domestically produced stabilizers.

On the basis of cooperation and specialization with the socialist countries through the Interkhim system, our country is the leading synthesizer of dialkyl-p-phenylendiamines. Furthermore, within the framework of the coordination program, studies have been completed on synthesizing hydroquinolines. This year the stage of experimentation in a pilot installation was concluded successfully. With the successful synthesizing of p-phenylendiamines and hydroquinolines the country's needs for the most effective and promising domestically produced rubber stabilizers will be successfully achieved.

Production of Sealers

The production of sealers is a developing area in the rubber-processing industry. It has been developed at a fast pace starting with 1963 in the scientific and production-practical areas. This was made necessary by the tempestuously growing machine-building sectors, such as car manufacturing, household machine building and increased construction industry requirements. The problems related to the development of technologies for various types of sealers, the use of special elastomers, designing sealers and instrument equipment, establishing criteria for assessing the quality of elastomer materials used in sealers, establishing criteria for the evaluation of finished goods and methods and testing equipment for research and controlling the durability of sealers and standardization have governed the activities of the institute's group which undertook the development of this sector and which became the Sealers Section. The influence of the Rubber Industry Area of the TsIKhP on developing the production of sealers in our rubber industry and, respectively, the establishment and development of the G. Tsanov ZTKI was controlling and decisive.

This area works in close cooperation with the IKhP in Kazanluk, LADA in Sofia, VKhTI in Sofia, the NIIRP in Moscow, the Gumi Werke NSP in Berlin and others. The Sealers Section represents Bulgaria in the Committee on Preparations for International Conferences on Sealer Equipment, periodically held by the socialist countries. It participates in sealer standardization activities in Bulgaria and CEMA. The section's laboratory for testing radial sealers for shafts has been put in charge of government testing.

The following are objects of scientific and application-production activities:

Fixed sealers ("O"-"P"-Rings, etc.); mobile sealers--for back-and-forth motion ("O" and "P"-rings, sleeves, and sleeve packets); mobile sealers for turning parts (radial shaft sealers); and shaped sealers for the chemical industry. Based on operation conditions, temperature intervals, pressure and fluid, the sealers are made of different elastomer materials or are combined with textile, plastic, metal and other reinforcing materials. Sealers which have been developed and are in regular production are manufactured in accordance with their purpose. They are essentially made of polybutadieneakrylonitril rubber with different contents of akrylonitril groups, polychloroprene rubber,

ethylene-propylene rubber and some general-purpose elastomers. New processes were studied and applied in the production of sealers, such as pressure casting, transfer casting, and continuing vulcanizing with super high tension current.

Between 1964 and 1984 the Sealers Section introduced in the rubber-processing industry 46 technologies for new types of sealers and improved quality sealers. The overall economic benefits were about 1.6 million leva. The G. Tsanov ZTKI was the main plant in which these technologies were applied. They were also applied at the ZTKI in Madan and Yambol, the Kapitan Mamarchev ZTKI, etc.

The first technology which was developed for the manufacturing of sealers in the rubber-processing industry was applied at the G. Tsanov ZTKI in 1964, for use in unstable K-sleeves for electric cars working within the temperature range between -30 degrees centigrade and +70 degrees centrigrade. This development improved the quality of electric cars. In connection with the increased requirements of the shipbuilding and hydraulic and compressed-air appliances industry, that plant developed and applied a number of technologies for the production of new types of sealers. The development of chevron rubber-textile packets withstanding a pressure of up to 32 MPa, working within a temperature range between -20 degrees centigrade and +80 degrees centigrade, imports from the FRG and the purchasing of a license for their production became unnecessary. Let us also mention the rubber-textile P rings for the Plesi KhZP, usable within a temperature range between -20 degrees centigrade and +100 degrees centigrade and -40 degrees centigrade and +100 degrees centigrade, with a pressure of 25 MPa. This type of sealer for a normal temperature range is produced both in our country and by the British Angus Company; those for the second temperature range are produced only in Bulgaria. In the case of sealers for special temperature ranges and with a view to upgrading quality, i.e., extending the reliability and durability of the sealers, new technologies were applied for sleeves, O-rings and radial shaft sealers.

The production of radial shaft sealers meeting USSR standards (GOST-8752) was a significant achievement in the application and production of radial shaft sealers.

For the first time in our country, under the supervision of specialists from the section, the G. Tsanov ZTKI and the ZTKI in Madan undertook the production of shaped sealers through continuing vulcanization with super high tension current. Technologies for such sealers with complex shapes for Chavdar buses (based on the Setra license) and sealer lining for refrigerators were developed by the institute. Full and porous sealers for construction purposes are manufactured at the ZTKI in Yambol.

Technologies for the production of various types of sealers and sealing parts for refrigerator compressors, based on the Linde license, an automatic washing machine based on the Perla license, transformers, ships, and others are being produced for the consumer machine-building industry, the electrical industry and ship building.

A forthcoming task is cooperation between Bulgaria and the USSR in developing technologies for the production of full and porous shaped sealers for construction, produced with the use of TSVCh [Super High Tension Current], on the basis of Soviet and Bulgarian raw materials. They were developed by the NIIRP in Moscow and the TsIKhP, on the basis of the plan for scientific and technical cooperation.

The activities of the section are aimed at developing the use of sealers made of special elastomers, such as silicons, fluorosilicons, polyurethanes, epichlorhydrin and fluorine rubber; development of new structures of fixed, flexible and shaped sealers. The development of the new elastomers and structures is also combined with that of suitable processing methods.

Production of V-Shaped Belts

V-shaped belts are one of the important rubber-textile items, both in terms of purpose and volume of output. They are used in industrial and agricultural machinery and motor vehicles.

For a number of years the main shortcoming of V-shaped belts was their general-purpose nature. Regardless of purpose, all of them had the same structure: cord-fabric and nonoptimal cross section.

In the cord-fabric design, the carrying structure of the belt is made of several plies of rubberized cord-fabric, which accounts for a significant percentage of the height of the cross section and covers not only the neutral line but the stress-bearing ply and some of the twisting ply. The individual plies in the cross section of such a belt cannot fulfill their functional purpose. Fatigue sets in quickly and the belt splits.

For a while, the cord-fabric structure was satisfactory because of low technical requirements. As a result of technological developments, however, the fast progress made in automobile engines in particular, such belts must perform under increasingly difficult conditions, such as high speeds, small driving pulleys and increased power. All of this required simplified V-shaped belts: more flexible, with greater fatigue resistance in repeated bending, and low stretching. This created new design problems. The appearance of cord-tread belts on the world markets called for mastering their production with suitable materials and equipment.

The Zebra SKKI is the only V-shaped belt producer in Bulgaria.

In 1975 the Rubber Industry Area was asked to design and develop equipment for the manufacturing of cord-tread belts.

A prototype machine for the manufacturing and a machine for V-shape cutting of fan belts up to 2,000 millimeters long was created. The regular production of some motor vehicle belts of world-standard quality was undertaken.

A number of other problems had to be resolved in order to ensure the overall solution of the problem of the quality of V-shaped belts.

We lacked a cord-impregnating installation. We imported impregnated polyester cord from the FRG, which was considerably more expensive than the nonimpregnated product. Furthermore, as a result of unrhythmical deliveries of cord, in most cases the impregnation guarantee expired, which reduced the adhesion between the tread and the rubber.

The plant lacked a modern calender line which could meet the strict requirements of rubberizing the fabrics and achieving the necessary precision in the thickness of the rubber lining: plus or minus 0.05 millimeters. The cord fabric was rubberized at the Vidin SKhK and could not meet the requirements of belt production technology.

The vulcanizing of the belts was one of the weakest areas. We lacked modern vulcanizing presses for the long belts and membrane vulcanizers for the short ones.

Quality control was not based on contemporary precision requirements in terms of raw materials and semifinished and finished items. The necessary equipment was lacking.

The development of a technology using materials with optimal features, without which the production of high-grade belts is inconceivable, required suitable equipment.

Our country was unable to design and develop heavy and complex equipment such as an impregnation installation, a calender line and the entire set of specialized machines necessary for the production of V-shaped belts.

In order to ensure the comprehensive solution of problems related to equipment, technology and testing of V-shaped belts, a license, the full set equipment and technology were purchased in 1980 from the American Gates Company. The license was applied at the Zebra SKKI in 1983. The plant is currently producing V-shaped belts of all types, based on the licensed technology. In order to determine the quality and reliability of the belts, the institute is keeping track of about 500 belts of various sizes which are being tested on motor vehicles, combines and industrial machinery.

The production of V-shaped belts based on this license began with original materials imported from capitalist countries. The purpose was to prove the validity of the guarantees given by the company regarding the suitability of the equipment, productivity, etc. The objective of the TsIKhP is to replace a maximal number of materials with materials produced in Bulgaria or in other socialist countries. Before the end of 1984 about 30 different items with features meeting the requirements of the licensing technology will be used.

Work is being done jointly with the Zebra SKKI on developing of an economically more advantageous technology for the impregnation of cord treads.

After the production of V-shaped belts has been stablizied and a maximal number of materials substituted with Bulgarian materials, the plant and the institute will work on the development of belts with different shapes needed by the country.

Anticorrosion Protection of Chemical Equipment with Elastomer Coating

The struggle against corrosion is a difficult problem facing contemporary science and technology. It can be resolved with various means. The question of anticorrosion protection in the chemical industry and economic sectors in which work is being done in strongly aggressive media is particularly important. Frequent use is made of expensive and scarce nonferrous metals and special stainless steels. However, they are inapplicable in heavy and large-scale equipment used in the chemical industry.

Coating with chemically resistant elastomers is a widely used method in protecting chemical equipment from the effect of strongly aggressive media. The rubberizing of chemical equipment in our country was started more than 25 years ago at the Zebra SKKI with using an ebonite mixture which required vulcanizing under pressure. This significantly limited the areas of application of rubber coating despite its good resistance to most of the then used aggressive media. Initially, the question of rubberizing was resolved with the use of Soviet plans and documentation and comprehensive procurements from a variety of Western companies. With the expansion of the production process, the question was raised of developing Bulgarian technologies for rubber coating of chemical equipment at the chemical combines in Devnya and Svishtov, in order to stop imports. The main requirement--vulcanizing with boiling water without pressure--is necessitated by the fact that the equipment cannot withstand increased pressure. The rubber lining and adhesives should be resistant to aggressive media at higher temperatures. A special glue was developed, which ensured strong manufacturing and post-vulcanizing bonding of the rubber with the metal. A thorough study was made on the influence of solvents, fillers, elastomers and adhesives.

This resolved the problem of anticorrosion protection at the Phosphorus Fertilizer Plant in Devnya, with a coating which could resist the aggressive media used at a temperature of up to 90 degrees centigrade, vacuum conditions and abrasive particles. A similar technology was applied at the Sviloza SKhK. The developed rubber lining technologies for heavy equipment and pipelines, started in 1972, are still in use. Tens of thousands of square meters have been rubber-coated and the coating has lasted 8 to 10 years. During the first year after its use economic benefits of 1,075,485 leva were achieved. Imports of rubber lining mixtures from Western countries was stopped.

A technology for rubber lining of mercury electrolizers, imported from the USSR, was developed for the needs of the Devnya SKhK. This resolved complex problems of anticorrosion protection against wet chlorine, which is an aggressive medium, as well as the means of coating equipment of complex design. The economic benefits of this technology totaled 78,729 leva.

Again for the needs of the Devnya SKhK, technologies for rubber lining of chemical equipment resistant to hydrochloric acid and aggressive media used in the production of phosphorus fertilizers at a temperature of up to 115 degrees centigrade were developed and applied in 1981-1983, with confirmed economic benefits of 264,280 leva.

The TsIKhP has made a significant contribution to resolving problems of anticorrosion protection at the Sviloza SKhK. Defects which had occurred in the course of transportation and storage, prior to assembling, had been discovered in the course of assembling the rubber-lined quartz filters imported from the USSR in 1973. The great hardness of the ebonite coating made conventional repairs with temperature vulcanization impossible. A technology was developed and applied for repairing the filters locally, using the method of vulcanizing hot air at a temperature of 70 degrees centigrade, within a very short time. At the same time, a technology was developed and applied for repairing pipes and shaped parts coated with the semiebonite mixture No 289, damaged in the course of transportation, storage and assembling. A great deal of time was saved and the prompt completion of the installation and commissioning of the plant for staple fibers was secured. Cases of partial ungluing of the bottoms of rubber lined containers for cellulose suspension increased in frequency in 1975. Within a short time a suitable solution was found involving the use of synthetic adhesives which ensured better adhesion with the metal and the old lining.

The Polynose Fibers Plant of the Sviloza SKhK used thick ebonite filler bodies imported from Japan. The same type of material manufactured on the basis of TsIKhP technology is as good as the imported product. Because of some specific technological features the system was applied at the experimental base of the TsIKhP, which has been producing several thousand such items annually since 1976. All in all, economic benefits totaling 376,402 leva have resulted from TsIKhP developments for protection from corrosion in the very first year after its application at the Sviloza SKhK.

Systematic studies of the resistance of elastomers containing abrasive particles in aggressive media were conducted. As a result, the TsIKhP experimental base undertook the production of protective signaling rings, used in geological drilling, with benefits totaling 86,159 leva. The rings are resistant to aggressive liquids, oil emulsions and abrasive substances and are superior to similar items previously imported from the FRG.

Along with applied development, the group for anticorrosion elastomer coating is conducting extensive scientific research to resolve some specific problems of resistance to chemically aggressive media. Systematic studies were made on the influence of the type of elastomers and some low- and high-molecular additives on the chemical resistance and physical and mechanical properties of ebonite, with a view to developing "flexible" ebonites. A study was made of the influence on the type and quantity of sealers and the level of adhension on the chemical stability of ebonites made of isoprene rubber.

Systematic studies were made of the chemical resistance of bielastomer soft compositions made of isoprene rubber with butadiene, butadienestyrene, chlorbutyl rubber and ethylene-propylene tripolymer. The decisive influence of the conversion of phases and phase conditions on the chemical resistance of vulcanizers was confirmed. A study was made of the influence of the degree of lacing (respectively, the time of vulcanizing) and the type of bonds (various accelerators and additional radiation lacing) and of the vulcanizing method on the chemical stability of natural rubber vulcanizers.

Some technological problems of rubber lining in vulcanizing were resolved in the development of anticorrosion compositions. A method was developed for obtaining sheets of rubber mixtures 3-6 millimeters thick. A study of the coating compositions used in rubber lining of pipelines, in order to improve their quality, was made. A method was developed for vulcanizing chemical equipment, thus improving the quality of the coating of edges.

The future plans of the group for anticorrosion elastomer linings of the TsIKhP called for the development of new elastomers highly resistant to strongly aggressive media and higher temperatures, eliminating the vulcanizing process through the use of self-vulcanizing and prevulcanized coatings and thermal elastoplasts. The possibility of rubber coating with liquid and paste compositions will be studied in order to improve labor conditions. New methods will be developed for repairing damaged linings. Other problems formulated by our industry, aimed at decisively improving the quality of output, will be resolved as well.

Basic Trends in the Development of Physical and Chemical Methods for Elastomer Studies

Development in any industry is inseparably related to the development of corresponding methods for production analysis and control. The methods which are used on a daily basis in the industry for purposes of quality control were considered new 15 to 20 years ago. A small circle of specialists were familiar with them and they were applied to the extent of the then available possibilities. By analogy, we should consider that the methods used currently by the institute in studying processes and properties of materials, considered new and contemporary, will assume a suitable place in every plant in a few years. This may be the safest and the only means of ensuring and maintaining the high quality of output on a steady level.

In the 30 years of TsIKhP life great progress was noted in mastering physical and chemical methods for the study of elastomers. The institute has modern equipment purchased from other countries or developed by its own specialists. A number of methods were mastered and applied in the study of polymers, such as infrared spectroscopy, X-ray structural analysis, nuclear magnetic resonance, wide-band nuclear magnetic resonance, stress relaxation, electron microscopy, thin-layer chromatography, gas chromatography, differential heat analysis, electrothermal analysis, etc.

The UR-20 infrared spectrometer (GDR) has been used for more than 12 years. Based on the characteristic absorption lines in theregistered infrared frequency spectra, the identification of the elastomer in the rubber and the raw rubber mixtures becomes possible. The same applies to vulcanizers, above all in the spectra of their pyrolysis products. Another more difficult problem, which has already been resolved, is that of identifying the polymers and their quantitative determination in the raw mixtures of two types of rubber and their vulcanizers. In this case, depending on the complexity of the system, in 2 to 3 hours a specialist can determine the composition of a new sample, item, unfamiliar part or material. In addition to identifying the type of rubber or the organic ingredients in the rubber recipe, infrared spectroscopy is also used in some quantitative determinations, such as the

content of nitril groups in butadieneakrylonitril rubbers, identifying cis- and trans-configurations in polybutadienes, the correlation between two types of rubber in a raw mixture or vulcanizer, etc.

Pyrolytic gas chromatography is used as well to identify elastomers. Compared with infrared spectroscopy, this method offers a number of advantages: high sensitivity, speed, no preliminary preparation of the sample, no more than a few milligrams of the studies material, etc.

Because of its high separation ability, nuclear magnetic resonance supplements the possibilities of infrared spectroscopy in identifying rubbers and organic hydrogen-containing ingredients in rubber mixtures. Essentially, this spectroscopic method is characterized by high precision and is essentially quantitative. It is used to determine the amount of nonvulcanized rubber in vulcanizers, changes in the number of double bonds in mixtures of isoprene rubber and the amount of cis- and transconfigurations in polyisoprenes.

Wide-band nuclear magnetic resonance has extensive possibilities. The Tesla BS 487 TsYaMR [Nuclear Magnetic Resonance] spectrometer has an attachment for recording spectra of solid bodies at room temperature. This is used to determine the relative mobility of the structural elements of the macromolecules (atoms, segments) in rubber mixtures and vulcanizers. The existence of a general interdependence between the second aspect of the broad-band YaMR spectrum and the dynamic module of vulcanizers consisting of a mixture of two rubbers has been established.

Some of the studies require knowledge of the molecular mass of the elastomers and tracing its changes under the influence of a variety of factors. This determination is based on the classical viscometric method for lack of more advanced equipment. The institute has tested and applied the accelerated methods for determining the characteristic viscosity of polymers and, respectively, their molecular mass, on the basis of a single measurement, the so-called "single point method." The most suitable formulas for computing the characteristic viscosity and, respectively, the molecular mass, based on a single reading, have been established for a broad range of narrow elastomer and solvent fractions.

Important conclusions relative to scientific research and the use of items and parts may be drawn on the basis of the results obtained from the study of the relaxation of vulcanizer stress. To this purpose, a group of specialists developed and mastered a photoelectric relaxometer, protected with an authorship certificate, which offers a number of advantages compared to other similar familiar equipment which enables us to trace the relaxation of the tension at different temperatures, deformation of samples and atmospheres.

The same collective developed two types of instruments for determining the level of heat shrinking of cord and fabric made of synthetic fibers. Priority in the manufacturing of such instruments has been secured. They can be used in plants producing items and parts with a rubber-textile structure, with a view to controlling the quality of the cord and the tread, and optimizing the degree of heat shrinkage, in connection with the durability of the items under functional conditions.

A system of electron microscopy has been mastered for the study of elastomers. The Tesla BS 500 electron microscope with high separation capacity is used in observing and determining the shape and size of particles contained in powderlike ingredients in latex. This method also enables us to determine the nature of the agglomerates of such particles which, in the case of latex, enables us to determine visually and rapidly their stability after long storage. The electron microscope enables us to observe structural formations in elastomers and olegomer products before and after chemical, heat and radiation hardening.

A method for thin-layer chromatography was mastered within the framework of bilateral scientific and technical cooperation with the NIIRP [Scientific Research Rubber Industry Institute] (Moscow), which was applied in the qualitative determination of anti-aging agents of the amine and phenol types in rubbers and vulcanizers. Essentially, the method consists of extracting the anti-aging substance and separating the extract through thin-layer chromatography. The identification of the anti-aging substance is achieved by comparing the factor and the coloring against the standards.

A method for determining the gas permeability of vulcanizers through gas chromatography with a heat conductivity detector was developed and mastered. This method, used in determining gas permeability, is characterized by its high sensitivity, accuracy and speed compared to conventional methods.

A method and equipment for electrothermal analysis of rubber mixtures during vulcanizing were developed. For the first time we observed an abnormal change in electric conductivity paralleling the vulcanizing of rubber mixtures in the course of gradual temperature increases. This effect is a new means of study of vulcanizing processes.

A basic trend in the activities of the collective in recent years has been to standardize the developed and applied analysis methods. The following standardized methods are suitable examples: identification of the elastomer in mixtures and vulcanizers consisting of trivial and special rubbers; identification of anti-aging substances of the amine and phenol type through fine-layer chromatogrpahy; determining the content of akrylonitril in butadieneakrylonitril rubbers, etc.

The mastery and application of these methods enables us to upgrade the level of development, to accelerate and facilitate the work of the scientific personnel and specialists and to create possibilities of forecasting scientific results.

Plastic Industry Area

Sofia KHIMIYA I INDUSTRIYA in Bulgarian No 8, 1984 pp 367-373

[Introduction by Candidate of Technical Sciences Khristo Kabaivanov]

[Text] The first scientific unit for processing plastic materials of the Ministry of Chemical Industry was established with the creation of a section

on plastics at the Leather, Rubber and Shoe Industry Scientific Research Institute in 1957. Initially, it consisted of only three scientific associates. Two sections were established in 1964: "Thermoplastics" and "Thermoreactive Plastics," which became part of the Rubber and Plastic Industry Institute, whose director was Senior Scientific Associate Atanas Vasilev.

The Plastic Materials Processing Institute (IPP), headed by engineer Ivan Golomeev, was established by combining the two sections in 1971, as a basic unit in the newly created TsNIRPD [Center for Scientific Development Activities] for the plastic-processing industry. The center included the bases for technical development of the P. Karaminchev, Asenova Krepost and Kapitan Dyado Nikola plants. The institute offered methodical guidance to the three BTR [Technical Development Bases] and provided scientific services to the enterprises of the Plastic Goods DSO.

Following the reorganization of the TsNIRPD into the Application Activities Directorate, the IPP merged with the Narodna Republika Plant, becoming the Narodna Republika NPP; after the Plastic Goods DSO was closed down in April 1978 it became the Narodna Republika NPK.

In 1979 the IPP became part of the Central Institute for the Chemical Industry, Plastic Industry Area. Currently it employs 38 people with higher education: four senior scientific associates, 17 scientific associates and seven candidates of sciences [sic].

The area has the following structural units:

Extrusion of Plastics Section;

Pressure Casting Section;

Vacuum Molding and Other Methods Section;

Secondary Processing of Plastics Section;

Plastic Testing Section;

Experimental Base and Experimental Prototypes.

The main task of this area is the application of scientific and technical achievements in the processing and utilization of plastic materials with a view to upgrading the technological standards of output and quality. It is implemented by:

Improving existing and mastering new plastic processing methods;

Mastering new items for the various economic sectors on the basis of domestic developments or utilization of foreign advanced experience with the help of equipment, documentation, and increased production, using acquired experience;

Modifications of polymers processing through filling, strengthening, defrothing, etc., with a view to increasing their various properties and their use and saving on polymer raw material and energy;

Studying the processes of aging and extending the useful life of polymer materials and goods through the use of effective stabilizing systems;

Developing effective technologies for the utilization and processing of plastic waste;

Developing and mastering the use of new methods for testing and assessing the properties of polymer materials and goods and upgrading their reliability and quality.

During the 7th Five-Year Plan and between 1981 and 1983 activities in this area were largely concentrated on mastering the production of new items through the intensive application of leading foreign experience achieved with the help of specifications (technologies) and equipment. The personnel in this area are leading participants in the study, substantiation and formulation of assignments for license purchasing, holding technical discussions, selecting leading companies, conducting acceptance tests as proof of guarantees and drafting technological documentation, instructions and standardization documents for the respective items.

Between 1970 and 1983 the scientific associates and specialists in the area participated in the application of more than 13 licenses with economic benefits in excess of 11 million leva. The more important among them were the following:

Mastering the production of plates and sheets of polymethyl-methacrylate (economic benefits of 402,000 leva per year);

Developing polyvinylchloride foil for the pharmaceutical and food industries (economic benefits of 227,000 leva per year);

Mastering the production of duplicating paper (economic benefits of 615,000 leva per year);

Self-adhesive tape (economic benefits of 1,324,000 per year);

Developing soles for ladies' shoes of expandable polyethylene (economic benefits totaling 698,000 leva per year);

Shapes of frothing hard polyvinylchloride for construction (economic benefits of 94,000 leva per year);

Developing paneling made of hard polyvinylchloride for construction (economic benefits of 400,000 leva per year);

Polystyrene laminates (economic benefits of 1,335,000 leva per year);

Developing furniture and decorative foil and packaging foil made of polyvinylchloride (economic benefits of 2,530,000 leva per year);

Developing double panels based on expandable polystyrene and internite (economic benefits of 1,014,000 leva per year);

Developing reinforced plastic hose (economic benefits of 200,000 leva per year);

Developing plastic corrugated cardboard and cardboard boxes (economic benefits of 420,000 leva per year).

The personnel in this area are closely cooperating with specialists in the development and application bases of economic combines in processing plastic materials. Based on the acquired experience and knowledge, in some cases they have increased the production of goods manufactured under license using Bulgarian equipment, such as increasing the production and variety of expanded polyvinylchloride shaped pieces for construction at the Narodna Republika SKPP, plastic panels made of polyvinylchloride at the Storgoziya Plant, etc.

In addition to active efforts to apply advanced foreign experience, the specialists in this area have completed a significant number of their own developments, the more important among which are the following:

Mastering the production of vacuum-shaped nonreusable containers for the Balkan BGA [Bulgarian Civil Aviation], with economic benefits of 350,000 leva per year and foreign exchange savings of 521,000 leva by stopping imports from capitalist countries, and earnings of 376,000 rubles from exports to socialist countries (USSR, Poland);

Developing a pallet box for the textile industry with economic benefits of 380,000 leva per year;

Mastering the production of glass-reinforced PA-S-30 polyamide based on the polyamide 6 vidlon using Bulgarian equipment with economic benefits of 400,000 leva per year and foreign exchange savings from stopping imports from capitalist countries of 800,000 leva per year;

Developing polyethylene battery cases for traction batteries, which earned the producer a profit of 786,000 leva;

Developing a new type of construction helmet with major social benefits;

Developing containers for blood storage and transfusion systems with a polymer needle, with an economic benefit of 238,000 leva per year. This item was awarded a gold medal at the 1983 Spring International Fair in Plovdiv;

Developing a vein cannula and urological catheters of the Timan and Nelaton types with economic benefits of 139,000 leva per year and foreign exchange earnings from capitalist countries of 240,000 leva per year.

Between 1979 and 1983 alone, after this area became a structural unit of the TsIKhP, it earned 2,691,000 leva, 1,394,000 leva of which from developments used in construction, 400,000 from machine building and 897,000 leva from use in the furniture industry, medicine and packaging.

The proven economic benefits of developments used in these areas totaled 3,401,000 leva and foreign exchange earnings totaled 4,080,000 leva for capitalist countries and 1,720,000 leva for socialist countries.

Between 1960 and 1983 the scientific associates and specialists in the Plastic Industry Area had a significant scientific output which included:

51 authorship certificates;

70 publications in foreign periodicals, 45 of which in socialist and 25 in capitalist;

More than 450 publications in Bulgarian periodicals;

Participation in the more 70 symposiums and conferences.

Fruitful cooperation with other Bulgarian and foreign institutes and organizations plays a substantial role in the development and application of topical and important problems in plastic processing. For the past 10 years the implementation of a program has been under way jointly with the Plastik NPO [Scientific Production Association] in Moscow, dealing with improving existing and developing new technological processes for the production of plastic goods. As a result of such cooperation, we have mastered the production of reinforced hose extensively used in machine building, the food industry, etc. The overall economic benefits from profits and lowering consumer costs are expected to exceed 700,000 leva. Also of great interest is the experimental-industrial production of coiled pipes made of polyolephines with a diameter of up to 630 millimeters, organized at the Kr. Rakovski Plant. They will replace metal pipes in the manufacturing of air ducts for the suction of aggressive gases, vapors, etc. They could also be used as an element in the heat insulation of metal pipes. Antistatic and self-extinguishing compositions for such pipes are being developed.

The area has drafted long-term joint programs for scientific and technological cooperation with the Eilenburg Chemical Works in the GDR, the Plastics Processing Combine in Ottendorf-Okrila Plastic Processing Combine in the GDR and the VUGTP in Gottwaldov, Czechoslovakia. Some of them include assignments dealing mainly with the extrusion of PVKh, the aging of polymer materials and goods, improving plastic testing methods, etc.

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Plastics in Construction, Furniture Industry and Packaging

Most of the plastic materials produced and processed in our country (26.5%) is used in construction. The use of such materials enables us to apply industrial methods. It facilitates and simplifies construction and installation work, reduces wet processes and improves the aesthetic appearance of private and public buildings.

The technical and economic prerequisites for the mass application of plastic materials are the following:

Considerably lighter weight compared to traditional construction materials;

Improved heat, sound and water insulation qualities of building structures;

Increased resistance to corrosion of some structural and facing elements;

Providing possibilities of consolidating elements and upgrading the level of prefabrication;

Offering opportunities for the architectural-artistic finishing of buildings and for "free planning";

Reducing the construction and installation costs.

Polyvinylchloride items find a most wide application in construction: in flooring, pipes and joints, electric and acid-insulation materials, separating walls, decorative shapes, double panels, heat and insulation and decorative lining, etc.

The Plastic Industry Area of the TsIKhP has studied, developed and applied a number of construction items. Most of them are produced with the help of specialized imported equipment which ensures high technical-economic and quality production indicators.

In 1974 the Storgoziya Plant undertook the production of dividing walls and doors made of extruded hard PVKh parts. Their use in housing, public and industrial construction helps to replace scarce timber, steel and nonferrous metals. Hard PVKh shapes from which light dividing walls and plastic doors are assembled, have very good physical-mechanical indicators, heat and sound insulation and delayed burning capacity and excellent resistance to moisture and steam. Construction elements made of such shapes have a level of soundproofing equaling that of hollow bricks with plaster, 11 centimeters thick. Their heat resistance equals that of a 28-centimeter thick wall made of ceramic bricks.

In 1976 the same plant mastered the production of plastic lining panels. They are made of hard PVKh 250 millimeters wide, 6 millimeters thick and 2,000-4,000 millimeters high. Such parts are produced through extrusion with subsequent offset printing which imitates various types of veneer. Plastic panels are less expensive than wood panels and can be installed much more quickly and easily. Lining plastic panels are very light (2.6 kilograms per square meter). They are washable and have a very good appearance. They are very successfully applied in public and residential housing. The economic benefits of this development exceed 300,000 leva.

Because of the great demand for plastic paneling, its production was increased. A Bulgarian facility for the production of paneling based on extruder Sh-90 was developed jointly with the NIPKITM in Pleven in 1977-1978.

The quality of this plastic material matches imported equipment. The application of the new Bulgarian line and technology saved $36,000. The annual production capacity is 85,000 square meters of plastic paneling.

Foam polystyrene (styropor) is extensively used in construction and machine building for heat and sound insulation. In order to meet the great need for such material, in 1975 the Vlado Georgiev Plant applied a method for the continuous production of foam polystyrene tiles based on a license purchased from the Swedish Gulfiber Company. The capacity of the installation exceeds 100,000 cubic meters per year.

Based on the initial raw material used, such tiles may be combustible or slow-burning combustion. They are 20 to 120 millimeters thick, 1,000 millimeters wide and up to 4,500 millimeters long, weighing between 14 and 55 kilograms per cubic meter. In the course of the production process the tiles may be cut in length or in width, from one or two sides, which allows various types of combinations in construction.

The capacity of the plant was increased in 1978 with the installation of facilities for the production of coupled styropor-internite elements. The equipment for the production of construction of elements with a core made of expanded polystyrene and with a variety of surface coats, one- or two-sided, is entirely automated. Such sandwich panels are used in the construction of dividing walls of one-story industrial buildings and agricultural and residential premises; fast construction of temporary and permanent one-story commercial buildings, which meet all the stipulations of labor organization, hygiene and safety; one-story camp buildings for brigades and the summer camps for students, the Bulgarian People's Army, etc.; lightweight resort construction; individual cottage construction; and roof insulation in industrial and civil construction.

The use of such coupled panels in construction releases manpower, accelerates construction, eliminates wet processes and drastically reduces finishing operations.

The use of a variety of edging and decorative plastic shapes in construction enables us to save substantial quantities of timber. In order to meet the great needs for such shapes in window and door production, in 1977 the TsIKHp installed equipment for the production of hard polyvinylchloride at the Narodna Republika Plant. By expanding the initial plastic composition in processing, items with a density of 0.5 grams per cubic centimeter are obtained, i.e., one-third the weight of conventional items made out of monolithic hard PVKh.

The expanded shapes made of solid PVKh have physical and mechanical properties similar to wood and a number of advantages compared to wood shaped items--exceptional shape retention, resistance to moisture and mold, slow burning, chemical stability, aesthetic appearance and easy installation. The use of 1-ton PVKh of such expanded shapes in construction saves the national economy 3.5 cubic meters of top-grade coniferous timber. Because of its low weight, the cost per linear meter of such parts is comparable to that of wooden items.

The production of expanded shapes was increased at the Narodna Republika Plant in 1980 with the installation of Bulgarian equipment and use of Bulgarian technology. Based on specifications developed at the institute, Bulgarian extruding lines for expanded shapes were developed on the basis of the PSh-63 extruder. The new Bulgarian lines were used in the production of expanded shapes at the Dograma SK [Economic Combine]. The quality features of such shapes produced with Bulgarian lines matched those produced with imported equipment. Furthermore, the Bulgarian lines have higher productivity. Proven economic benefits from this development exceed 200,000 leva.

In order to increase the use of polymers in construction, the specialists in the Plastic Industry Area are working on a number of problems which are leading the country to advanced positions. Thus, for example, a technology was applied for the production of sanitation engineering items, paneling, and others made of polymer concrete and artificial marble. These items are manufactured entirely on the basis of Bulgarian raw materials--polyester resins and mineral fillers (marble dust, mosaic No 2, limestone, etc.). Their indicators are superior to similar items made of other conventional materials. Furthermore, power outlays for the production of sanitation and paneling items from polymer concrete and artificial marble cost almost half the cost of the same items made of traditional materials such as cast-iron, porcelain or faience. The use of the new material and technology for the production of items from it creates prerequisites for developing the entire manufacturing of sanitation assemblies of the same material, coloring and shapes, which will make their aesthetic and comprehensive finishing possible. The specialized Architectural Design State Commission of the Committee for Art and Culture, the Union of Architects in Bulgaria and the Union of Bulgarian Painters gave a high rating to the comprehensive system of items for paneling and the installation of sanitation units already manufactured at the SKhK in Botevgrad. In addition to sanitation engineering items, the new material could be used in lining and replacing natural marble, concrete and other traditional materials.

A collective from the Plastic Industry Area, together with specialists from the development and application bureau at the Kapitan Dyado Nikola SKPP, developed and applied in the combine a technology for the production of polypropylene pipes for hot water, chemically aggressive substances, etc. They will be extensively used as elements in developing systems for subflooring and subsoil heating. Together with the New Energy Sources NPSK [Scientific-Production Economic Combine] a system was developed for subfloor radiation heat using polypropylene pipes. The first batches of such prolypropylene pipes, produced at the Kapitan Dyado Nilola SKPP, based on a technology developed by the collective, have been used in some experimental systems for floor radiating heat in existing buildings. The results of the initial tests have been positive. A system for subsoil heating in greenhouses was developed jointly with the Polimerstroy NPK, which has increased yields by several hundred percent; fuel, metal pipes and labor have been saved.

Plastic materials have a variety of uses in the furniture industry. They replace scarce materials, improve the functionality and reduce the labor-intensiveness in furniture production. In order to replace expensive scarce veneer, in 1983 a TsIKHp collective and the development and application bureau

at the SKhK in Botevgrad undertook the regular production of furniture and decorative foil at the Botevgrad SKhK. With the help of modern complex equipment procured from the Berstorf Company in the FRG, high-grade plastic foil, which can imitate various types of wood veneer, is produced through calandering and subsequent printing and stamping. With an annual output of 25 million cubic meters, economic benefits from this development exceed 2.5 million leva.

The TsIKhP is also working on the use of various plastic materials and items for packaging.

Following the installation of equipment for the production of vacuum-shaped baskets made of polystyrene sheets for prepackaged grapes, at the Narodna Republika Plant, in 1973, the production of vacuum-shaped discardable containers for the Balkan Bulgarian Civil Aviation was undertaken. The two sets of containers--large and small--which were manufactured put an end to imports from capitalists countries and met the requirements of the Balkan BGA for services aboard international air routes. Economic benefits from this development total 150,000 leva per year.

Our pharmaceutical industry imported large quantities of transparent solid PVKh foil from capitalist countries for packaging pills and other medicinal drugs. In 1976 the TsIKhP collective undertook the production of hard PVKh foil for the pharmaceutical industry at the Narodna Republika Plant. The production of transparent hard PVKh foil with a thickness ranging from 0.1 to 0.7 millimeters and a width of 1/1000 millimeters, and an annual capacity of 1,500 tons, was mastered with economic benefits in excess of 500,000 leva.

In order to save on cellulose and imported corrugated paper for the production of boxes made of corrugated cardboard and as a result of the installation of new polypropylene production capacities in 1981-1982, the TsIKhP collective installed at the Plastic Processing Plant in Gotse Delchev falities for the production of polypropylene corrugated cardboard and the manufacturing of boxes for packaging a variety of goods. The production of shaped corrugated cardboard made of polypropylene-copolymer through extrusion with a special shaping injector, with a maximal width of 2,000 millimeters and a thickness of 2, 3, 4, 5 and 6 millimeters, was mastered. This equipment enables us to produce two types of boxes--stapled and assembled. The possibility exists of multiple and 2-tone printing for external decorative appearance of the boxes.

The physical and mechanical features of plastic corrugated cardboard are superior to paper cardboard. Its basic advantage is its exceptional resistance to moisture, mold and chemicals, and its repeated utilization.

The capacity of the equipment exceeds 3,000 tons per year of plastic corrugated cardboard and boxes. Annual production benefits exceed 400,000 leva.

In connection with the use of containers and pallets in the textile industry, in 1981 the TsIKhP undertook the production of large-sized box-pallet at the Narodna Republika Plant, for the transportation of yarn spools. The box is made of polypropylene-copolymer through pressure casting. It is 800x600x750

millimeter container, with legs, which makes four-prong processing with a powerlift or pallet cart possible. The case has a nominal hauling capacity of 60 kilograms and a payload of 260 liters and can be piled four high. Annual economic benefits equal 380,000 leva.

Plastics In Machine Building

Developments with extensive application in machine building and the electrical industry play an important role in the work of the Plastic Industry Area. In recent years polymers have been used in industry replacing traditional materials. The need for plastic materials for construction and industrial use has increased sharply. New highly efficient polymer materials are used in industry; the new items which are being manufactured help to modernize important industrial sectors.

Research and development efforts have been made to improve the quality of domestically produced bakelite molding powder used in the electrical equipment industry. Quality standards of molding powders and basic materials for their manufacturing have been set. Recommendations have been made improving the technological process at the P. Volov Plant.

Two types of molding powders were developed and are being produced at the Lakprom Plant for the needs of the Electrical Equipment Plant in Plodiv. They are based on asbestos and wood-asbestos fillers, brands 4 and 10, based on Italian standard UNI 4303. They are used in pressing industrial items and large-sized circuit breakers, based on an Italian license. The annual economic benefits of the use of Brand 10 molding powder alone is 104,360 leva. Foreign currency is saved as well.

Research has been done to modify bakelite molding powders with the use of different polymers, such as polyvinylchloride, nitril rubber, etc. The P. Volov Plant developed jointly with the NIIPM in Moscow the polyvinylchloride-modified bakelite molding powder RSM 143-T with a fiberglass filler. It has very good strength and electrical insulation qualities which meet specifications for the manufacturing of parts for VAZ motor vehicle at the ZEACh [Automotive Vehicles Parts Plant] in Elkhovo.

Work was done on processing thermosettings molding powders using the highly productive pressure casting method. Instruments for the production of various items made of bakelite molding powder and melopas were developed and applied at the Plastkhim Plant.

Brand PA-A polyamide is produced in large-sized blocks 60 to 250 millimeters thick, weighing up to 300 kilograms. It is used in the manufacturing of parts and items by mechanical treatment of the blocks on metal and timber-processing machines. It is resistant to the effect of lubricants, petroleum products, organic solvents, alcohols, and synthetic washing detergents. It is extensively used in machine building as antifriction material replacing nonferrous metals and their alloys in friction parts. It is also used in the manufacturing of large-size parts in small series, prototypes, and parts for the repair and maintenance of machines and equipment in machine building, etc.

Scientific research and technological work has been done to master the production of glass-reinforced thermoplasts, which hold an intermediary position between thermoplasts and metals. They combine metallic and electrical insulation characteristics of metals with the easy processing of thermoplastic plastics.

A complex extrusion granulating line has been developed using Bulgarian equipment and technology for the production of glass-reinforced polyamide, based on polyamide 6 Vidlon, produced at the SKhK in Vidin. This polymer is produced on a regular basis at the Khimik Plant as PA-S-30. It is used essentially in the manufacturing of individual structures and as a substitute for nonferrous metals and their alloys. Glass-reinforced polyamide has high-strength properties, usable within a broad temperature range, an elasticity module in the range of lightweight metals, a low linear expansion coefficient and low water absorption. The resulting items are distinguished by their high precision and dimension stability, for which reason the PA-S-30 polyamide is used in machine building, instrument making, electronics, electrical engineering, etc. Its use in complex technical solutions is based not only on its high strength indicators but also its relatively easy processing with pressure casting in the manufacturing of items with complex dimensions and insignificant creeping.

Economic benefits from the use of PA-S-30 total 400,000 leva per year and savings of foreign currency equal 800,000 foreign exchange leva per year.

PP-S-20X and PP-S-20S glass-reinforced polypropylene is a polymer used in manufacturing items for household and industrial use. It has improved physical-mechanical features such as resistance to stress and static twisting, pressure, hardness and elasticity module. Low water-absorption, combined with high dielectric indicators, allows the increased use of this material in the electrical appliances industry. It is produced on a regular basis at the Khimik Plant.

The achievements and development of contemporary Bulgarian machine building are inseparably related to the production of electric cars and batteries in which our country has specialized within CEMA. An important stage in modernizing the electric cars was replacing ebonite with plastic battery cases. The institute's developments eliminated the need to purchase from abroad expensive equipment and instruments for the production of the necessary large number of plastic battery cases. An original variant, protected with an authorship certificate, was applied in developing a double cradle injector for battery cases. The production of battery cases at the Narodna Republika Plant, based on instruments and technology developed by the institute, reached some 1.4 million cases per year. The plant earned 786,373 leva from the production of battery cases. Foreign exchange was saved by eliminating imports of expensive injectors and plastic battery cases.

The Kom Plant developed a polypropylene pallet case by request of Intransmash, as a result of which the production of transporters, conveyor belts and automated gravity racks was mechanized. The estimated economic benefit totals 180,000 leva.

Polymers In Light Industry, Consumer Goods and Medicine

New materials and items are being created for the needs of light industry, consumer services and medicine; technologies for their industrial production are being developed and applied and specific methods for their rating are being introduced. A great variety of items for different purposes are being manufactured in this area, which determines the great variety of polymers used. Great attention is paid to the development of polymer compositions based on specifications. A variety of modification methods are used, such as the development of polymer mixtures, filling, expanding, etc.

The developed technologies for the industrial production of items for the shoe manufacturing, household and medical industries include virtually all known methods for processing plastic materials (pressure casting, extrusion, heat and vacuum shaping, high frequency welding, etc.), as well as decoration methods (stamping, coloring, lining with decorative foil, etc.).

Various granulates of plastified polyvinylchloride for bottles, wading boots and shoe soles, both thick and porous, were developed and are being produced at the Kapitan Dyado Nikola SKPP and the Kom Plant. Economic benefits have totaled 322,000 leva and foreign exchange of $394,000 has been saved. The annual production of PVKh granulate for the shoe industry increased from 300 tons in 1971 to 8,000 tons in 1983.

The Vlado Georgiev Plant developed and applied a technology for the production of various types of platform shoes and lightweight soles for ladies's shoes made of polymer compositions based on polyethylene and ethylenevinylacetate copolymer. The economic benefits of this application totaled 567,000 leva.

A variety of household utensils, toiletry items and other consumer goods were developed. The Pirinplast ZPU [Plastic Items Plant] is producing 40,000 sets of utensils with colanders developed by the TsIKHp. A number of discardable items are being manufactured, such as trays, bowls and others, which are finding increasing application at home.

The TsIKhP specialists helped the SKhK in Botevgrad to master the use of a license for the production of polystyrene laminates and vacuum molded items in construction and consumer goods. Economic benefits from their production exceed 1 million leva.

A system was mastered for the production of polyester buttons. Most of the imported raw materials were replaced by domestic ones. The buttons produced at the Kom Plant meet the needs of our country in terms of variety and volume.

Methods were developed for decorating plastic items for household use (melamine utensils), produced at the Plastkhim Plant.

The use of polymers in medicine is increasing steadily. This is manifested in the increased volume of parts and items produced for medical purposes and the broadening of their variety. The reason for this is found in the favorable physical-mechanical and chemical-biological characteristics of polymers.

Items for medical purposes made of polymer materials are exceptionally varied in terms of type and purpose: instruments, apparatus, packaging for medicinal drugs, items for servicing patients, equipment for medical and dental offices, and parts and artificial implants. The percentage of nonreusable items is increasing significantly. This lowers the risk of infectious diseases and facilitates the work of the medical personnel.

In addition to special polymer materials used for implants, medicinal drugs, etc., basic polymers as well are used in medicine: polyethylene, polypropylene, polyvinylchloride, etc. Particular attention is being paid to their composition and purity. Polymer materials for medical use must be physiologically harmless, stable in their use and resistant in sterilization. Modified, they may be given other specific characteristics such as providing X-ray contrasts, thromboresistance, etc.

Blood transfusion and extraction systems, Butterfly catheters, urination bags, etc., are being used in our medical practices. New items are being developed for hematology, blood transfusion, urology, gynecology, hospital services, laboratory work and the pharmaceutical industry. Studies are being made on the selection of polymers for medical use. Suitable polymer compositions and technologies for their industrial production are being developed; specific research and control methods are being applied.

A number of new items for medical use have been developed and produced in recent years. Plastified polyvinylchloride containers for taking and preserving blood were developed. They are industrially produced at the Kom Plant, with proven economic benefits of 196,000 leva. Based on a TsIKhP development, the Momina Krepost Plant is mastering the production of a vein canula with economic benefits of 122,000 leva. The same plant has installed facilities for the production of urological catheters of the Timan and Nelaton models with savings of 240,000 foreign exchange leva.

The production of double blood bags, new types of transfusion systems and items for use in gynecology, the packaging of pharmaceuticals, etc., will be mastered.

Scientific research on the development of modern polymer materials and items for medical purposes are being coordinated through CEMA. The problems on which the TsIKhP is working are included in the program for scientific and technical cooperation among CEMA member countries. Our country is participating in the implementation of a joint work plan for the development and production of items for hematology and blood transfusion and other medical items.

Filled Polymers--An Important Reserve in the Conservation of Petroleum Raw Materials and Energy

In recent years extensive scientific research and application efforts have been made to apply high grade fillers for polymers and new brands of polymer compositions--filled polymers. Such activities became particularly intensive in the wake of the 1974 energy crisis. The higher pace in the production of filled polymers is based not only on the need to conserve petroleum raw

materials and energy but also the possibility of obtaining plastic materials with improved technical and economic indicators on the basis of the filling of mass produced polymers.

Local production of plastic materials containing suitable mineral powder fillers increased rapidly. With the help of such materials 1 ton of polymer materials can replace an average of 2 to 3 tons of mineral fillers, with a practically unlimited raw material base. Raw materials and energy used in the production of 1 ton of polymers required 2-4 tons of petroleum at an international cost of $200-$250 per ton. On the other hand, power outlays per 1 cubic meter of filler consisting of fine ground limestone is 3gJ compared to 60 and 80gJ for the same amount of polyethylene and polypropylene, and 350 and 550gJ for steel and copper.

Bearing in mind that in the near future the economic development of a country will be rated not only in terms of increased energy units but also reduced power intensiveness of output, the figures we mentioned indicate the great importance of the use of filled polymers.

Considerable progress in polymer filling has been achieved in the industrially developed countries. The USSR has developed a wide variety of filled polymers. A new trend has been developed in the production of filled polymers directly with the synthesizing process (a polymerization filling method). The Kompozit Specialized Scientific-Production Trust was set up for the production and development of filled polymers. The USSR Council of Ministers State Committee for Science and Technology has developed a special target program entitled "Polymer Fillers," which involves the participation of more than 60 scientific institutions and industrial enterprises.

The GDR and Czechoslovakia are producing on an industrial scale suitable polymer fillers and using items based on filled thermoplastic polymers, such as polyethylene, polypropylene, polystyrene, etc. The GDR Academy of Sciences, the Lacquers and Dyes Institute in Gliwice (Poland), the Macromolecular Chemistry Institute in Brno (Czechoslovakia) and others are actively involved in the study and production of filled polymers.

A number of advanced capitalist countries are paying great attention to the accelerated production of filled polymers. In the United States, for example, the production of polymer fillers is expected to increase from 1,322,000 tons in 1976 to 3,063,000 tons in 1986, i.e., by a factor of 2.5-3; production by the end of the century is expected to reach 15 million tons, i.e., an increase by a factor of 11. In 1980 the United States produced about 2 million tons of fillers, or 10 percent of the amount of produced polymers; 75 percent of them are mineral and inorganic fillers (excluding glass and other fiber fillers); calcium carbonate (chalk) is the most frequently used material (60-70 percent). It is expected that in 1990 the overall consumption of this filler will reach 18-20 percent of the overall amount of plastic materials produced; this amount will exceed 25 percent by the year 2000.

Currently our country uses surface-rough mineral fillers for polymers accounting for some 10 percent of the overall amount of produced plastic materials and synthetic resins. This is a high percentage which is due mainly

to the considerable amount of filling of polyvinylchloride plastisols for flooring. Existing possibilities of using fillers in our country are not being fully used and our target is to reach world-wide standards in this respect.

The development and production of high grade fine-dispersed surface-processed (finished) mineral fillers is a basic problem. The fine dispersion of fillers is of essential importance in the production of high grade fillers. Worldwide practice calls for the use of fillers with average-sized particles ranging from 0.5 to 3 microns and up to colloidal dimensions of 0.05 microns and maximal particle size of 10-12 microns. High quality, high-dispersion light fillers can replace carbon black, which is an expensive filler used in the rubber industry.

The production of high grade fillers and filling polymers is a difficult task which involves the solution of complex scientific development, technical and organizational problems. One of the difficulties is that this task is being implemented in different production areas, ranging from the development of quality fillers and their finishing to the production of filled polymers and their use in manufactured items. Filled polymers have specific characteristics which must be studied in detail with a view to accurately determining their areas of processing and application. A wrong approach or gap between production and application may yield mediocre or undesirable results. The need to coordinate the efforts of our different institutes, bases and collectives resulted in the elaboration of the "Development and Application of Polymer Fillers and Filled Polymers" national coordination program, which was approved and adopted in May 1983. The TsIKhP was assigned a coordinating role in this program because of its available necessary broad range of work areas in inorganic production (fillers), surface-active agents, plastic and rubber processing, testing polymer properties, rating their aging process, etc. The basic producers are the branches of the MMMR (MMER) [Ministry of Metallurgy and Energy Resources] and the Ministry of Chemical Industry.

Despite the fact that the program was recently started, positive results have been achieved: specialists from the VMGI [Higher Medical Hygiene Institute] and the TsIKHp conducted successful semi-industrial tests for the production of a high-dispersal filler of the base of natural calcium carbonate at the N. Vaptsarov Shop of the DOSOM [State Construction Materials Economic Trust] in Basarbovo Village, Ruse Okrug. The fine ground lime has a granulometric composition of less than 15 microns and meets the requirements of polymer fillers. In the course of the grinding, two finishing products were developed by a TsIKhP collective. The finished fine-dispersion chalk provides filling compositions based on PE, PP and PVKh, with very good physical and mechanical indicators. The tests conducted at the Kapitan Dyado Nikola SKKPP indicate that the finished Basarbovo limestone can replace the Omiliat 955 brand in the production of a number of extrusion items.

The TsIKhP is working on the development and study of new finishing systems for fillers based on various cationide, anionide and non-ion surface-active agents.

The TsIKhP collective is also working on improving the granulometric composition of the limestone precipitate produced in our country and on a technology for its finishing in the course of the production process.

Scientific research has led to the development of optimal recipes technologies for filling PE, PP and PVKh with finished limestone. Imported Omialen 4, Omialet 95T and Polycarb S fillers were used for comparison purposes.

A fine ground Basarbovo limestone was developed with imported finishing substances such as titanates produced by the Kenrich Company (United States), the Hoehst Company (FRG) and others. Various polymer concentrates with different fillers were tested as well. The comparative tests indicate that the recipes and technologies for the production of filled polyolefines with ground Basarbovo limestone, developed by the institute, are yielding good results. Sample quantities of items made of filled polyolefines have been produced. The Kr. Rakovski Plant has installed facilities for the production of non-pressure types made of filled PVKh with a 20 percent suitably finished precipitated limestone. Economic benefits from the processing of 1,000 tons per year of solid PVKh average 60,000 leva.

The Storgoziya Plant has applied a technology for the production of wall paneling with filled hard PVKh with energized limestone precipitate. Tests conducted at the Kapitan Dyado Nikola Plant for the production of items filled with fine-dispersed limestone have indicated the usefulness of high-filled PVKh compositions. Studies are under way on the development of suitable mixtures of polyolefines with dispersion mineral fillers in the production of films and foils and the quality of foil materials made of recycled polymers and for lowering the production costs of heat-shaped packaging containers.

The development of various technologies for the production of filled polymers is combined with research along two basic lines: determining the aging process of filled polymer compositions, with a view to developing materials with better operational indicators and greater reliability, and studies on the wear of machine parts in their processing. To this effect, the filled compositions are subjected to artificial and natural aging and the influence of fillers, mineral deactivators, anti-aging substances, and others is tested. Natural aging is achieved under suitable comparable conditions in the open. New original methods have been developed to study the wearing of machine parts in processing filled polymers. Studies are under way on the influence of the amount of various fillers and type of finishing used on the wear of plastic processing machines.

Properties and Methods of Assessing Plastic Materials and Goods

The intensive use of plastic materials in the various national economic sectors requires good knowledge of basic characteristics, i.e., the development of the study of plastics.

The TsIKhP is developing its scientific research and applied activities in polymer material studies along three lines:

Support of technological scientific-applied developments with accurate experimental data on the properties of plastic materials and items;

Scientific research developments of a theoretically and applied nature dealing with the properties of plastics and their changes under different influences;

Development of new methods and systems for evaluating plastic materials and products.

The Plastics Testing Section works on determining the basic physical-mechanical, physical and physical-chemical characteristics of plastics with the help of contemporary analytical methods and instruments. Several teams have been set up according tc the specific nature of the work in the section: physical-chemical laboratory, physical-mechanical laboratory, analytical laboratory and a laboratory on aging.

Polymer raw materials are rated in terms of density, bulk weight, melting temperature, granulometric composition, viscosity of solutions, etc.

The mechanical properties of the materials and items are studied under stress, pressure, bending and shock with standard dynamometric machines.

Surface mechanical properties are determined in terms of hardness, abrasive wear or adhesion characteristics.

The behavior of polymers with temperature increases and decreases is determined through differential heat analysis, thermogravimetry, deformation resistance in bending (Martens Method) penetration (Vick Method), low temperature brittleness and resistance to shock.

The dielectric properties of plastics are studied by determining their electric resistance, electric strength and tangent of dielectric losses.

Plastics aging has been the topic of extensive research. An exposure station for atmospheric aging in a maritime climate has been in operation since 1974. Over the past 10 years it has collected data on the natural aging of mass-produced Bulgarian plastics and studied their compositions with a variety of stabilizing systems developed by the institute's technological sections. The degree of aging is rated through changes in resistance indicators, color changes based on the colorimetric method, changes in the chemical composition with the help of infrared spectroscopy, changes in light transmission of transparent plastics in the visible and ultra-high ranges, etc.

Studies of accelerated aging are conducted in premises equipped with artificial climate, mercury light and regulated temperature and moisture, in order to determine relative aging stability. Some polymers are studied for heat aging only, depending on their purpose and use.

The data gathered on aging of plastic materials are used to optimize their composition and to forecast changes in their operational characteristics.

The hygiene properties of plastics are of great importance in their use in the food and pharmaceutical industries. Modern chromatographic methods have been mastered in recent years to determine the content of free monomers in items made of polystyrene and polyvinylchloride.

Specific functional tests are made to assess the functional readiness of the various types of plastic items, based on their purpsoe.

The section has mastered and is applying more than 75 different methods to determine the various propertis of plastic materials and items.

Direct help is given to the plastics processing industry by conducting arbitration and certification control tests and identification analyses. The number of such tests conducted by the section is increasing rapidly. It has increased from some 5,000 leva's worth in 1974 to 16,400 leva in 1983.

The considerable amount of research and applied work to develop new equipment and methods for assessing the functional readiness of semifinished and finished goods include the following:

Development of documentation and prototypes of known standard operational equipment for natural aging under pane glass and aging with simultaneous bending stress;

Development of a testing panel for the study of the mechanical longevity of plastic materials at room and higher temperatures;

Development of a testing panel and method for determining the resistance to shock with a drop lance on polymer foil. The instrument includes two types of weights (under 300 grams and from 300 to 1,300 grams), dropped from heights ranging from 50 to 150 centimeters. This equipment helps to provide a qualitative rating of polyethylene, polystyrene and polyvinylchloride soft and hard foils;

Designing and manufacturing an instrument and developing a method for rating the resistance to shock of solid plastic sheets and shapes up to 50 millimeters thick with multidirectional strikes with a free swinging weight. The shock energy ranges from 10 to 250 J.

Scientific research for developing new equipment and methods leads to drafting new standardization documents and criteria for setting quality standards of Bulgarian plastic goods.

The study of polymer technological and physical-mechanical properties requires considerable experimental and preparatory work in developing new compositions and technologies in the manufacturing of prototypes. The large amount of work necessitated the setting of a separate experimental-technological base in this area. With the help of specialists from the technological sections, the base tests the technological nature of new compositions and the possibility of using new technological approaches in solving problems. It is equipped with extruders, an extruder-granulator, mixing shafts, vacuum machines, and machines for casting under pressure and pressing. Such equipment enables us

to rate the technological standards of the new compositions and the quality of newly manufactured tools for processing plastic materials under industry-simulated conditions.

Furthermore, some newly developed items are produced on a pilot basis. This is particularly useful in studying the needs of the national economy with the use of finished prototypes.

The experimental-technological base applies new technologies in processing plastic materials developed on the basis of specifications provided by or jointly with foreign organizations, with a view to gaining experience, studying requirements and making the necessary preparations for industrial production in the country (polyolefine blanks, one-step pressure casting method with glass-reinforced polymers, etc.).

Sectorial Scientific, Technical Information

Sofia KHIMIYA I INDUSTRIYA in Bulgarian No 8, 1984 pp 374-375

[Text] The Center for Sectorial Scientific and Technical Information of the Central Institute for the Chemical Industry--the leading scientific-application organization in the sector--was established in 1980 in accordance with party and government decisions related to the development of scientific information in our country.

The center is the sectorial body for scientific and technical information. It is guided in its activities by current legal and methodical documents on the development of a national system for scientific and technical information and the orders and instructions of the Ministry of Chemical Industry and the TsIKhP.

In the course of its extensive activities, the Center for Sectorial Scientific and Technical Information carries out a number of assignments as follows:

Organizes, plans, coordinates, provides methodical guidance and supervises overall activities related to scientific and technical information within the system of the Ministry of Chemical Industry;

Studies information requirements of leading cadre and specialists from the Ministry of Chemical Industry and the TsIKhP and, together with sectorial and local information authorities, the needs of all other categories of consumers within the sectors;

Coordinates on a sectorial scale the obtaining of information sources and their processing, based on the principle of the optimal utilization of funds and, particularly, of capitalist currency;

Together with sectorial information authorities, organizes and participates in the development of a unified sectorial information center based on the division of labor in processing sources, thus creating and maintaining a central scientific-information stock on general sectorial problems and topics of subsectors not serviced by specialized sectorial bodies;

Organizes and participates, together with the other information units within the sectorial system for scientific and technical information, in developing and keeping data arrays on the technical level of the sector, the level of technologies it applies, the quality and technical and economic indicators of produced items, materials and goods, compared with data on indicators achieved by leading countries and companies throughout the world;

Provides comprehensive information services to leading cadres and specialists from the Ministry of Chemical Industry, leading cadres, scientific workers and specialists in the TsIKhP and, on request, to all other organizations in the sector on general sectorial problems and topics of sectors not serviced by specialized sectorial bodies;

Organizes and engages in centralized publishing activities;

Organizes and engages in the gathering and dissemination of information on domestic and foreign leading experience in the sector;

Develops and participates in the implementation of steps aimed at the automation of information activities;

Establishes and maintains bilateral cooperation with sectorial information chemical industry bodies in the USSR and the CEMA members;

Represents the sectorial system for scientific and technical information for the chemical industry in the international sectorial system for scientific and technical information of CEMA member countries--INFORMKHIM--and secures the implementation of our country's obligations stemming from its participation in this system.

In the course of the implementation of such assignments, the Center for Sectorial Scientific and Technical Information engages in a variety of activities aimed at providing high-standard scientific and technical information. A prerequisite to this effect is the center's rich scientific and technical library, which is basic for the chemical industry sector on a national scale. The stock of primary and secondary documents and published and unpublished sources includes some 200,000 recorded units, including scientific and technical books, periodical and nonperiodical publications, company prospectuses and catalogues, descriptions of inventions related to authorship certificates and patents, standards, reports on scientific research developments, etc. It is a subscriber to 700 periodical and nonperiodical publications, 400 of which are Soviet and 165 from the capitalist countries, some of which are unavailable to other libraries in the country.

Information services are provided to consumers on all levels on the basis of a comprehensive analytical-synthetic processing of available documentary stock and facilities of specialized scientific and technical libraries in the country and the automated systems developed by the TsINTI [Central Scientific and Technical Information Institute] and information materials supplied by INFORMKHIM. Extensive use is made of the system of selective dissemination of data with a view to meeting lasting information requirements on the condition

and development trends of items of interest, and information is provided on an individual basis to requesting consumers. The center's specialists use investigative and interview methods in making periodical studies of demand for scientific and technical information.

In the area of information services, ways and means are sought for the application of new and more advanced forms and methods. The percentage of scientific and technical information supplied to leading cadres of the Ministry of Chemical Industry of an analytical-survey nature, containing sifted, evaluated and synthesized information, with conclusions and multivariant recommendations, for management decision-making, has been increased.

Seven information publications of the Center for Sectorial Scientific and Technical Information provide general information services. They enjoy a good reputation among consumers in the country and abroad.

The "Production-Economic Information" collection supplies information on new processes and products, the utilization of byproducts and waste from chemical production, and the condition and trends of development in the chemical industry throughout the world. The information contained in the bulletin is of a practical nature and is presented as precisely consisting of one or several sources and included qualitative indicators. This publication meets the basic information requirements of a wide range of sectorial consumers on different levels.

The "Technical-Economic Chemical Industry Data" collection supplies factual information which describes the condition and trends of development of the chemical industry as a whole, individual subsectors or selected production facilities. This publication is used in drafting plans, forecasts, engineering blueprints, etc., and for purposes of comparative studies.

The purpose of the bibliographic publication "Signal Information On General-Sectorial Problems of the Chemical Industry" is to serve specialists in the sector and to combine materials dealing with general sectorial topics. Feedback charts allow consumers to obtain copies of prime sources.

Bearing in mind the great opportunities which leading experience in production and management provides for the accelerated enhancement of technical, organizational and technological production standards and for improving production quality, a bulletin entitled "Leading Experience in the Chemical Industry" is published. Not least in terms of its importance is the official use only bulletin "Scientific Research Developments in the Country and in CEMA Member Countries," the information leaflet "Reports On Assignments Abroad" and the bulletin "New Books and Company Publications."

The reference materials prepared by the Center for Sectorial Scientific and Technical Information have a multiple purpose. They are used in current management work, assessment of technical standards of operating production facilities and quality of output, the requirements the Khimkomplekt ISO, in planning, etc.

The Center for Sectorial Scientific and Technical Information organizes or drafts analytical surveys based on a plan approved by the Ministry of Chemical Industry, containing synthesized information and critical assessments of the condition and trends in the development of a given type of production or in specific problem areas. This is achieved with the help of highly skilled and narrowly specialized sectorial specialists. Preparations were started this year for the publication of annual analytical reports on the most topical problems in the chemical industry.

In order to facilitate consumer access to valuable information sources not received in our country, the center will undertake to develop a stock of microfiche sources, procured through the central exchange microfiche copy fund of the international INFORMKHIM system. Bearing in mind foreign exchange restrictions and the steadily rising prices on the capitalist book market, this is the only means of maintaining optimal stocks with minimal foreign exchange expenditures.

Through its participation in INFORMKHIM, the center ensures reciprocally advantageous international cooperation in the area of scientific and technical information. This helps to upgrade the efficiency, quality and speed of information services in the sector, contributes to the development of the sectorial system for scientific and technical information for the chemical industry through the computerization of information processes, provides reciprocal access by consumers to the information stocks of the socialist countries and, last but not least, creates scientific, methodical and organizational prerequisites for the steady improvement of information processes. The two automated systems for scientific and technical information for chemistry and chemical technology and for trade and economic information for the chemical industry are in their experimental stage; they will begin operations on a regular basis respectively in 1984 and 1985.

The survey data subsystem provides consumers with analytical-synthesized surveys on the most topical problems of the chemical industry in the "Contemporary Problems of Chemistry and the Chemical Industry" series (as many as 16 titles per year, in the Russian language) as well as national surveys drafted on the basis of the coordinated and consolidated plan, totaling some 100 titles annually.

The facility for the dissemination of printed information publications and individual requests give our consumers access to printed publications on chemical topics, for which no subscription is possible, and to the information facilities of participating countries, containing a total of some 12 million documents.

As the organizational and methodical head of the sectorial system for scientific and technical information for the chemical industry, the Center for Sectorial Scientific and Technical Information develops the necessary stock of documents of legal and methodical nature, needed for the proper implementation of scientific and information policy in the chemical sector.

The Center for Sectorial Scientific and Technical Information will continue in the future to assist the enhancement of information standards and information support of consumers and to upgrade the quality of information activities.

Standardization in Chemical Industry

Sofia KHIMIYA I INDUSTRIYA in Bulgarian No 8, 1984 pp 375-376

[Text] Under the conditions of the comprehensive intensification of the national economy, in which the problem of upgrading production quality is of great importance in building a socialist society, the role of standardization as a link in the system of controlling the technical standards and quality of output becomes particularly important at all stages of scientific development, and the design, manufacturing and utilization of output.

Standardization activities are directed above all towrard the following:

Formulating parameters which define quality indicators for basic products and items in accordance with worldwide scientific and technical standards;

Conserving raw materials, materials, fuels and energy;

Ensuring labor safety and environmental protection;

Ensuring the more dynamic development, confirmation and application of standardization documents.

The basic tasks of standardization bodies and services are determined in accordance with standardization development trends. The sectorial standardization centers play a particularly important role in the development of such activities.

In 1980 the TsIKhP set up a Standardization Center, which provides scientific and technical and organizational-methodical guidance in overall standardization activities within the Ministry of Chemical Industry system.

The institute's personnel actively participate in the development of topics based on the State Standardization Plan, issue competent views on CEMA and ISO plants and draw up CEMA projects. They provide direct assistance to application units in the development and application of scientific research developments in industry. Such interaction is of particular importance in upgrading the efficiency and productivity of technological processes, in upgrading the quality of new and improved items, in environmental protection, etc.

In the wake of the May 1983 quality conference in Varna, the Ministry of Chemical Industry undertook preparations for and the holding of a state-public review of the quality of chemical industry goods. Steps were earmarked to improve a number of technical and economic production indicators as early as 1984-1985, which will also bring about changes in standardization documents for various items, such as:

1. Truck radial tires as follows:

Size 8.25R20--reducing material-intensiveness from 51.2 percent to 50.8 percent and reducing wear from 80 cubic millimeters to 78 cubic millimeters.

Size 9.00R20: lowering material intensiveness from 48.8 percent to 48.3 percent and reducing wear from 80 cubic millimeters to 78 cubic millimeters.

2. M-2600 belts for agricultural machinery:

Increasing service life from 7 hours to 7-18 hours.

3. Polyester cotton-type 1.5d/tex fibers.

4. Deviation of average fiber thickness from nominal thickness: not to exceed plus or minus 4 percent, compared to the existing plus or minus 5 percent deviation;

Specific binding strength of the basic fiber: no less than 53CM/tex, compared to the current 51CN/tex.

4. Suspension polyvinylchloride:

Reducing the content of moisture and volatile substances from 0.38 to 0.36 percent.

5. "Ulita 85 WEP" and "Ulita 90 EP" transmission oils:

Viscosity index: from 90 to 95;
Coke residue: from 0.70 percent to 0.65 percent.

6. AMV thinner:

Guaranteed storage: from 6 to 24 months.

7. PF-12 enamel-lacquer alkyds:

Viscosity based on VZ-4 at 20 degrees centigrade: so far the lower limit only has been standardized to no less than 70 seconds; it has now become necessary to standardize the upper limit--70-160 seconds;

Shrinkage at 20 degrees centigrade to level 4: from 40-48 hours to 36 hours;

Guaranteed storage, from 12 to 14 months.

The TsIKhP sponsored a state-public review on upgrading the quality of scientific research and development and earmarked steps aimed at decreasing the economic and social efficiency of developments, the more important among which are the following:

Ensuring the direct participation of the TsIKhP as equal partner in the discussion and adoption of sectorial programs, application of foreign

experience in license purchasing, enhancing technical standards and quality of output, etc.;

Formulating comprehensive TsIKhP work programs in fertilizer production, plant protection chemicals, dyes, auxiliary industrial and construction agents, polymer and elastomer additives, etc.;

Designing industrial installations for low-volume chemicals, providing total engineering facilities in some cases.

The standards and sectorial norms drafted by the TsIKnP should reflect the most advanced achievement of scientific and technical progress and the demands of foreign and domestic consumers.

Standardization plays a basic role in the efficient utilization of production aspects and the conservation of raw materials, materials, fuels and energy. Particularly good results have been achieved wherever the standards include optimal structural and technological solutions according to which, without lowering the consumer value of an item or worsening the technological process, the fewer possible materials, fuels and energy are used. This requires preliminary extensive studies based on science and progressive experience in the following areas:

Development of essentially new technology and items of reduced weight, using local available materials or designing technological processes requiring optimal fuel and energy expenditures;

Improving existing goods and providing possibilities of replacing materials, reducing sizes, lowering amounts of fuel and energy in their production, etc.;

Utilizing raw material and material waste.

It is precisely this which determines the policy regarding standards: high criteria in the formulation and approval of standards for new items and technologies, systematic reviews of current standards with a view to amending their stipulations relative to the expenditure of material resources and developing standardization documents on efficient utilization of raw material and material waste.

During the 6th Five-Year Plan the Ministry of Chemical Industry received more than 37 suggestions relative to Bulgarian state standards and norms on the conservation of raw materials, materials, fuels and energy and reducing imports; the TsIKhP extensively participated with a number of developments, as follows:

Polyethyleneglycols: 300,000 leva saved as a result of stopping imports;

Cyclohexanone: a cyclohexane mixture involving the utilization of waste products;

Study of destruction and stabilization processes of elastomers and vulcanizers, thus saving on raw and other materials and extending the useful life of motor vehicle tires;

"Verafil" synthetic fibers grease: savings of 200,000 leva as a result of stopping imports, developed by the Verila SKBKh.

General technical standard systems have become increasingly important in recent years. They have a substantial influence on improving production standards and accelerating the practical utilization of scientific and technical achievements. An important sectorial standardization task in this respect is the drafting of a Uniform Technicological Documentation System (ESTD), which is currently applied exclusively by the machine-building sector. The TsIKhP drafted the first two basic standards for the chemical industry system in 1983: "ESTD. Basic Stipulations" BDS [Bulgarian State Standard] and "ESTD. Basic Terms and Definitions in the Chemical Industry" BDS. Another five documents within this system will be drafted in 1984.

In order to establish a single procedure in the development-application area, the chemical industry sector drafted and approved Standard 02 74168-84 "Development and Industrial Utilization of Chemical Industry Products," the [.1.1] of BDS 15,000 001-81. The document was drafted by a task force of specialists from various areas of the sector.

In order to set up a procedure for planning the production of specific socially necessary products and items, ensuring the uniformity and mandatory nature of information on ever increasing varieties in economic sectors and the creation of conditions for the extensive application of standardization and unification principles in mastering the production of new items in the country, the unified catalogue system (EKS) was set up. The development of a Sectorial Catalogue System for the Chemical Industry (OKSKhP) as part of the EKS is a major TsIKhP task. In this area the TsIKhP performs the function of a OKSKhP center, based on the EKS, as follows:

Drafts standardization documents for the OKSKhP;

Formulates draft five-year and annual plans for products to be catalogued;

Drafts or organizes and manages the drafting of catalogue lists for the sector;

Establishes and maintains a sectorial catalogue library.

Development of Forecasting

Sofia KHIMIYA I INDUSTRIYA in Bulgarian No 8, 1984 pp 376-377

[Text] The great importance of the chemization of the national economy in the socioeconomic development of the country determines the increasing need for extensive preplanning development of an essential element in managing the chemical complex. The TsIKhP has been assigned a leading role in the implementation of this responsible task. In accordance with the party's

requirement of public production intellectualization and the requirement of a systematic enhancement of the scientific substantiation of the plans for the development of the sector at the present stage, a qualitatively new approach to the formulation of chemical production studies and forecasts is necessary. It was in this connection that the Forecasting Comprehensive Target Programs and Scientific and Technical Policy Section was established in 1979. Its three basic functions are development and methodical and organizational-coordination.

Many specific results in terms of method support were achieved since its establishment. For the first time a standardizing document for forecasting activities was drafted within the chemical industry system: "methodical instructions, forms and indicators for the formulation of forecast and comprehensive programs in the chemical industry sector." Sectorial cadres were trained in forecasting. A "Cycle of Lectures on Forecasting" was published. Specialists were trained at the National Training Center for the Uniform Social Information System.

Along with the creation of a method base and enhancing qualification standards, substantial progress has been made in organizing sectorial forecasting. The section drafted and implemented a unified plan for forecasting developments within the chemical industry system, coordinated by the TsIKhP. The institute is the main source of most forecasts and is developing in close connection with the other forecasters: The INN, VKhTI [Higher Chemical and Technological Institute] in Sofia, the BRV [Development and Application Base] at the G. Genov SKhK and the BRV at the Fokhar Factory.

The main feature of the adopted work style is the establishment of comprehensive collectives with the participation of all leading specialists in the country for the specific subsectors and areas covered by the separate forecasts. Specialists are used even more extensively as experts in the collective expert evaluations of developed forecast variants. In this manner the TsIKhP reflects and sums up the forecasts made by leading specialists in the chemical complex and in other areas. This leads to more objective analyses and greater forecasting accuracy.

The following were formulated, accepted and applied in the formulation of the plans for 1984-1985 and the 9th Five-Year Plan, as a result of such overall activities: 20 forecasts on the development of the individual subsectors and chemical production facilities, a comprehensive forecast on the development of the chemical industry through the year 2000, a forecast on the energy consumption in the sector through the year 2000, a forecast on the development of scientific research and developments within the sectorial system, etc. A comprehensive approach was applied in all developments. The forecasts on the development of the sector and its subsectors were formulated after comprehensive studies were made covering a significant retrospective period and the quantitative and qualitative indicators and developing trends in consumption, production and raw materials, international markets and scientific and technical progress on a worldwide scale in the leading countries and in Bulgaria. The views on future development were based on specific technical and economic assessments of the level of Bulgarian production facilities. Such concepts include expected production volumes and

structure, resource availability and expected results. Using a set of analytical and forecasting indicators, the forecast on scientific research and development provides a profound comparative study of the condition, level and efficiency of NIRD [Scientific and Development Work] in the country, in other countries and throughout the world, and its cadre, financial and organizational support. Alternate forecasts on the ways and indicators of such development and the necessary resources were drafted. Basic scientific research problems and tasks to be implemented in the future were formulated. Priority was given in all developments to problems related to upgrading the quality of overall activities in the chemical complex, in chemical output in particular. In this manner, the work of the Forecasting Comprehensive Target Programs and Scientific and Technical Policy Section and of all leading TsIKhP specialists, who participated in the formulation of the forecasts, is directly focused on enhancing the level of scientific services in the sector and formulating and systematically updating development prospects.

The section maintains contacts with a number of similar units and other sectors at home and abroad. It is engaged in fruitful joint activities in the economics, organization and management of the chemical industry share of the VKhTI in Sofia. It is in direct touch with the National Forecasts Club, the corresponding units of the Ministry of Machine Building and Electronics, the Forecasting Laboratory at the Lenin VMEI and others. It maintains very useful contacts with a number of institutes in the socialist countries, specializing in forecasting and technical and economic studies, such as the NIITEKhIM [Scientific Research Institute of Technical and Economic Research of the State Committee for Chemistry] in Moscow, the VUTEKhP in Prague and others. Although it is relatively less experienced, the TsIKhP is successfully participating in making joint forecasts with these institutes, working within the CEMA Permanent Commission for Cooperation in the Chemical Industry and the INTERKHIM MIO.

The forecasting activities of the TsIKhP and Forecasting Section respectively, which have acquired an organized and systematic nature and assumed a qualitatively new content, are manifested in scientific publications as well. Over the past 3 years, 23 works on forecasting have been published or accepted for publication and 10 papers have been read at scientific meetings in the country and abroad. They deal mainly with the application of basic forecasting principles in the chemical industry sector, the selection and adaptation of analysis and forecasting methods, specific forecast concepts on the development of some structure-determining chemical production facilities, etc.

Meeting the new stricter requirements of science, set by the National Party Conference on Quality Problems, is directly related to the increasing need for scientific forecasting of socioeconomic development and scientific and technical progress and the systematic formulation of substantiated data on future developments. This particularly applies to the chemical industry as one of the most dynamically developing sectors with a multiplying effect in other areas of economic and social life. It would be expedient for the forecasting activities within this sector to be developed further on the basis

of previous achievement and acquired experience, and for the TsIKhP leading role in such activities to be asserted even more. Considerable possibilities of expanding and intensifying forecasting exist in the following areas:

Development of technological forecasting and study of innovative processes in the sector;

Development of markets for chemical products and raw materials for their production;

Possibilities of using local raw materials in the chemical industry;

Application of biotechnologies in the chemical complex;

Development of cadres in the chemical complex and their most expedient utilization and means of training;

Development of the sector, basic subsectors and basic chemical production facilities between the years 2005 and 2010 (including updating of forecasts through the year 2000);

Participation in the development of major sectorial problems, such as food supplies, environmental protection and others;

Development of integration processes in the socialist community through the years 2005-2010 (jointly with institutes in the USSR and other socialist countries);

Developing methods for forecasting in the stipulated areas, comprehensive forecasting of the consequences of scientific and technical progress, etc.;

Developing the optimal structure of forecasting units and others.

Work on such comprehensive and important problems requires further improvements in the qualificational standards of cadres engaged in forecasting and increasing their number; seeking new and improving current forms of participation of highly skilled leading specialists in forecasting. The planned systematic principle of forecasting must be consolidated through the elaboration and adoption of an overall five-year plan for sectorial forecasting. The further expansion of cooperation and joint work between the TsIKhP, on the one part, and the NIITEKHIM in Moscow, VUTEKhP in Prague, IEKhP in Warsaw and others, on the other, in the field of forecasting is a major prerequisite for the further improvement of pre-plan developments and for upgrading their efficiency.

By upgrading its qualification standards, strengthening planning and improving topics and its methodical base, the TsIKhP will continue to assert itself as the leading scientific unit in the system of sectorial forecasting.

Socialist Labor Organization

Sofia KHIMIYA I INDUSTRIYA in Bulgarian No 8, 1984 pp 378-379

[Text] The rich material and technical base of the chemical industry which has been developed, modern technologies, original scientific and technical discoveries and the use of new raw and other materials may be highly effective only with a socialist organization of labor.

The main purpose of the socialist organization of labor is to ensure the steady increase in labor efficiency through the fullest and most efficient utilization of labor tools, raw materials, materials and energy and the most efficient and economical utilization of manpower, combined with concern for the health of the people and increased attractiveness of the work.

The Center for the Socialist Organization for Labor was set up as part of the TsIKhP and approved as an engineering-application unit with Order No 1-266 of 10 May 1980 of the Ministry of Chemical Industry, with the following objective activities: scientific research, design and application of developments for the socialist organization of labor, with a view to the steady enhancement of labor efficiency in the sectorial economic system of the chemical industry. It is implementing its activities in accordance with the methodical instructions of the Ministry of Chemical Industry, the Committee for Labor and Social Affairs, the State Committee for Planning, the State Committee for Science and Technical Progress, government decrees, orders and other legal acts relative to the socialist organization of labor. As a TsIKhP unit, the Center for the Socialist Organization for Labor participates in performing development, organizational-methodical, coordination and application functions relative to the socialist organization of labor.

The center's activities include the implementation of the following tasks:

Methodical management and coordination of the work of units in charge of the socialist organization of labor in economic organizations and providing scientific and technical, methodical and practical aid to economic organizations and their branches on problems on the socialist organization of labor;

Together with the economic organizations and their branches, developing and applying standard labor organization plans for workplaces, sectors and shops;

Sectorial norms and standards for labor outlays of basic and auxiliary personnel, ITR [Engineering and Technical Workers] and employees; methods, instructions and suggestions for improving the socialist organization of labor; progressive forms of labor organization (brigade intracost accounting, combination of functions and skills, multiple-machine servicing, etc.); rate-qualification manuals; standard work and recreation systems; and professional diagrams for basic and auxiliary professions within the sector;

Study and summation of Bulgarian and foreign experience in the organization of labor, formulation of instructions and recommendations for its extensive utilization in the sectorial economic system, participation in courses and

seminars for the dissemination of leading labor methods and participation in the organization of exhibits on the scientific organization of labor;

General sectorial scientific-applied research on the organization of labor, development of concepts, forecasts and analyses, and programs for their improvement;

Participation in the elaboration of sectorial plans for scientific research with a view to the comprehensive solution of problems related to improving the socialist organization of labor;

Scientific developments, drafting methodical instructions and standardizing materials in accordance with national coordination programs for resolving scientific and technical problems in the field of labor organization;

Research in labor norming and participation in the development of uniform labor norming materials;

Formulation of plans for the organization of production and labor based on contracts with economic organizations and their branches and their joint application;

Scientific and technical cooperation on problems of the socialist organization of labor, aimed at making use of achievements and leading experience in this area;

Assisting the ministry and the economic organizations in teaching courses for upgrading the skills of managing and performing cadres on problems of the socialist organization of labor;

Preparing for publication, in accordance with stipulated procedures, of standardizing method and information materials on the socialist organization of labor.

The center employs highly skilled specialists--engineers, economists, physiologists, psychologists, scientific associates and candidates of sciences--organized in problem groups dealing with standard and individual labor organization planning; labor outlay norms; brigade organization of labor and leading experience; and labor conditions.

The center has already developed a number of topical problems of labor organization, thus contributing to the advancement of the socialist organization of labor in the chemical industry.

The center has developed sectorial method data and instructions for improving the socialist organization of labor by elements, a brigade organization of labor based on cost accounting, multiple-machine servicing, labor norming for basic and auxiliary workers, standard and individual designing, professional charts for basic professions in the chemical and pharmaceutical industries, optimal labor and rest schedules, etc. These are extensively applied in the design activities of the center and the department for socialist organization of labor in the combines and chemical industry sectors.

The following developments have been applied: departmental norms for labor outlays in the manufacturing of industrial rubber goods, spraying in the plastic processing industry, extruder production and norms relative to the numbers of basic workers at the Aroma Plant in Sofia and rating norms in the chemical industry.

Departmental labor norms were drafted on the basis of studies and a critical analysis of labor norming organization. Based on enterprise norms, scientific, uniformly stressed and progressive labor norms are drafted. Such norms are entirely applicable in the other industrial subsectors.

The labor norms are drafted on the basis of efficient organizational-technical and other conditions of the labor process, as stipulated in the standard plans for improving the organization of labor; their application parallels the introduction of such conditions.

As a result of the organizational-methodical activities of the Center for the Socialist Organization of Labor in setting up a scientific standard base, the number of workers working on the basis of norms, compared to the overall number of people employed in the chemical industry, reached 38.9 percent with confirmed economic benefit from the center's developments totaling 200,000 leva.

With the active assistance of the economic organizations and the Ministry of Chemical Industry, the Center for the Socialist Organization of Labor developed and applied a number of standards and individual plans for improving the organization of labor in the production of nitrogen fertilizers, the rubber and plastic processing industries, the production of calcinated soda and the chemical-pharmaceutical and cosmetic industries. These projects were applied in the economic chemical combines and their branches in Sofia, Devnya, Vratsa, Dimitrograd, Svishtov, Yambol, Razgrad, Troyan, Gabrovo, Berkovitsa, Pazardzhik, Kostenets, Ravno Pole Village and elsewhere, between 1977 and 1983.

Work is under way this year to improve the socialist organization of labor and the norming base for basic technological workers at the SKhK in Vidin and Devnya. Work is also being done on the topic of "Comprehensive Research for finding Optimal Solutions for Labor Hygiene, Psychophysiological and Social Problems in the Production of Antipyretics."

By decision of the Ministry of Chemical Industry Collegium, dated 12 February 1980, the Center for the Socialist Organization of Labor is in charge of coordinating, providing methodical guidance and developing 18 program tasks within the sectorial coordination program for the development and application of standard and individual plans for improving the socialist organization of labor in work places, sectors and shops (1981-1985). The main purpose of the program is to develop all the necessary technical, economic and organizational prerequisites and conditions for the implementation of extensive engineering-application activities for improving the socialist organization of labor in

the chemical sector on the basis of standard and individualized plans for the organization of labor, based on the experience of the USSR and the other socialist countries and on domestic developments.

The main purpose of the program is to coordinate the efforts of all units in charge of the socialist organization of labor in economic organizations and the Center for Socialist Organization for Labor, making efficient use of the existing scientific potential and preventing duplication in the work; utilizing opportunities for standardization and dissemination of leading experience and the experience of the socialist countries on problems of the socialist organization of labor; and comprehensively utilizing the forces of creative collectives. Included in the implementation of the program are the following economic organizations: the Neftokhim SK, the SNKhK in Pleven, the SKhK in Devnya and Dimitrograd, the Sviloza, G. Genov, P. Karaminchev and D. Dimov SKhK, the SKhK in Vratsa and Vidin, the Asenova Krepost SKPP and others.

In addition to its program tasks, the center also works on the basis of contracts with economic organizations. In 1983 alone plans formulated by the center had a proven economic benefit in excess of 500,000 leva and the program assignments for the coordination program, 2,052,000 leva; in other words, the efficiency of the center, in terms of returns on funds invested in research and design was 1:5.

Joint work with the Ministry of Chemical Industry and specialists in this area and the collectives of economic organizations is particularly important in the activities of the Center for the Socialist Organization of Labor. The efforts are focused on upgrading the efficiency of the application of standard and custom-made systems for improving the socialist organization of labor in individual economic organizations and collectives and multiplying this effect throughout the national economy.

In the future the center will expand its activities by undertaking work on additional problems aimed at improving the socialist organization of labor in accordance with the new party stipulations on intensifying output, quality and efficiency and adopting a comprehensive approach in resolving interrelated problems. Several basic tasks have been set as follows:

1. Methodical guidance and coordination by the Center for the Socialist Organization for Labor: formulation of methodical materials and coordination programs and offering consultation to specialists in economic organizations, thus upgrading the work efficiency and quality of units in charge of socialist organization of labor in economic organizations.

2. Drafting scientific plans for economic combines, aimed at improving the organization of labor on the basis of the new stipulations on the extensive application of the brigade organization of labor of a new type and upgrading the quality and efficiency of the end results of purposeful labor activities.

3. Improving the sectorial norming base for labor outlays through the formulation of standards and norms for labor outlays for basic and auxiliary workers and regulating the number of auxiliary personnel in economic combines through the study and analysis of the distribution of workers in the chemical

industry by service areas (basic and auxiliary activities) and, on this basis, determining the optimal ratio in the chemical industry.

4. Final analysis of factors which affect turnover in chemical industry enterprises: formulation of programs and measures to reduce turnover.

5. Improving the existing skill rating manual and drafting characteristics for the introduction of new jobs and new and stricter qualification requirements.

6. Study and development of problems of social and psychophysiological labor conditions in the chemical industry.

The center's specialists actively participate in scientific conferences, symposiums and other forms of scientific cooperation in the country and abroad with reports and communications on problems of labor organization. That is how they have developed lasting relations with TsNOTKhIM [Center for the Scientific Organization of Labor in the Chemical Industry] in Moscow, the House of Technology in Prague, and the Labor Institute of the Ministry of Chemical Industry in Warsaw. Such bilateral contacts contribute to the study and sharing of leading experience in labor organizations. A considerable number of articles, scientific reports, communications, monographs and studies have been published by the center's associates.

Ever since it was established, with the support of the administrative, party and trade union leadership of the TsIKhP, the Center for the Socialist Organization of Labor developed and proved its role as a leading unit in the area of the socialist organization of labor in the chemical industry.

Inventions Listed

Sofia KHIMIYA I INDUSTRIYA in Bulgarian No 8, 1984, p 380

[Text] TsIKhP scientific research and engineering-application activities offer its specialists opportunities for extensive work as inventors. The institute has a long tradition in this respect. A number of new technologies, materials and plants-protection chemicals, protected with authorship certificates, have been developed within it.

A patent bureau was set up in 1981 to assist in the creation, processing and protection of inventions related to topics developed by the institute. With the help of INRA [Rationalizations Institute] foreign patents have been sought on behalf of the TsIKhP. TsIKhP specialists are given competent advice on the legal aspects of patenting.

The institute has set up an Inventions and Rationalizations Foundation financed through legal channels.

The administration organized invention and rationalization activities on a planned basis. A comprehensive development program for 1983-1985 was adopted, updated on an annual basis. Good results were achieved during the five-year plan in terms of the number of invention requests: 48 in 1981, 58 in 1982 and

68 in 1983. Seventy percent of the applications submitted have been recognized as inventions.

The patent specialists studied the patent possibilities of the topics developed at the institute on a planned basis.

A patent form was drafted and its use supervised in accordance with recently promulgated invention regulations. It is based on in-house instructions.

The patent form includes a conclusion relative to the patent purity of the invention. In 1983 the patent experts studies 41 items over and above the planned figure. A number of inventions developed within the TsIKhP have been applied in our industry. They include:

"A method for obtaining superphosphate-phosphorite fertilizer," developed by N. Kostadinov et al., applied at the SKhK in Devnya, with economic benefits totaling 930,000 leva.

"A method for greasing synthetic silks," developed by El. Slavormirova et al., applied at the Leon Tadzher NPZ [Scientific Production Plant] and the D. Dimov SKhK.

"A method for obtaining stilbene optical bleaches," developed by S. Takeva et al., applied at the chemical plant in Kostenets, with economic benefits totaling 192,000 leva.

"A method for waterproofing buildings and masonry," developed by R. Georgieva et al., rated by the INRA as the invention of the month. It is being applied in Apriltsi.

Gold medals were awarded to the following inventions at the 38th Samples Fair in Plovdiv: "Method for Greasing Synthetic Silks" and "Antiadhesive for Greasing Rubber Goods," developed by T. Tsekova et al., and "Water-Oil Ceazine," developed by S. Gaytandzhiev and G. Decheva. The invention "Thick Rubber Belts With Improved Indicators," developed by L. Rel'ovski et al., was awarded a gold medal at the 39th Samples Fair in Plovdiv. "Chloracetophone-50," the pioneering invention (by N. Khlebarov and N. Bozhkova) was developed at the TsIKhP. A special installation was set up at the Agriya Chemical Plant for the manufacturing of this basically new insecticide.

Interest in some of the inventions by TsIKhP specialists has been shown in foreign countries as well. As early as 1981 we received a report from the GDR that the preparation "Tetranicid 20-20," invented by N. Khlebarova et al., was superior to the local preparation and that the GDR would yield its markets in Cuba, Czechoslovokia and the GDR providing that Bulgaria would undertake its production.

According to an Austrian newspaper, a letter from the FRG indicates an interest in V. Manov's invention of a concrete additive.

The Khimkomplekt ISO has reported that Iran has shown interest in purchasing technological documentation for a urological catheter and urine, blood and serum bags developed by Ang'ozova et al.

As a result of the interest shown by the GDR in Evg. Dzhagarova's invention "Elastomer Composition of Penicillin Plugs," the Khimkomplekt ISO is making preparations for the sale of a license or know-how.

All of this proves that the inventions developed at the TsIKhP are being used in the international exchange of scientific and technical achievements. That is why the important forthcoming task of the institute's management will be to organize the patenting of our achievements abroad, to sell licenses and know-how and to export items. Such activities are closely related to the country's economic policy and the observance of certain specifications, such as:

Conducting market studies;

Supervising commodity prices;

Studying the patent situation;

Studying the competitiveness of the products we develop. In response to the instructions on developing an automated information system, under the guidance of the Ministry of Chemical Industry, the TsIKhP NIKhFI [Scientific Research Chemical-Pharmaceutical Institute] signed a contract for joint activities in introducing an automated patent information system developed by the British Dervent Company. This information system will meet the needs of the entire chemical sector.

In accordance with the contract concluded among the TsIKhP, NIKhFI and TsMI and between the TsIKhP and the BAN [Bulgarian Academy of Sciences] the following must be completed before the end of the year:

Drafting a program for computer data retrieval;

Training patent specialists in operating the system;

Testing the system under industrial conditions.

The purpose is to undertake the regular use of an automated system for patent documentation retrieval by 1985.

Bearing in mind the forthcoming additional assignments, it will be necessary to reorganize the activities of the patent bureau as well. A group will be set up in charge of receiving and processing topics submitted by the TsIKhP and the chemical sector in a way suitable for machine processing and dialogue, as well as submitting the retrieved documents to the consumer. Another group will conduct patent and market studies related to sales or purchases of licenses and know-how. It will be necessary to set up yet another group in charge of legal protection of new technical solutions in the chemical area: drafting descriptions and authorship claims and giving consultations on patent law.

International Cooperation

Sofia KHIMIYA I INDUSTRIYA in Bulgarian No 8, 1984 pp 380-381

[Text] With every passing year cooperation among CEMA member countries in science and technology is turning into one of the most important factors in scientific and technical progress in the socialist countries and in accelerating their economic development and upgrading public production efficiency.

The TsIKhP is engaged in scientific and technical cooperation with all socialist countries. It participates in the coordination of scientific research through CEMA, INTERKHIM and INTERKHIMVOLOKNO MPP [International Sectorial Organizations]; it is the basic agency in our country for the INFORMKHIM MOSNTI [International Sectorial Economic Scientific and Technical Institute] and cooperates with companies in the capitalist countries.

The volume of joint scientific research is increasing with every passing year. In 1983 bilateral work covered 25 topics, 13 of which with the USSR, six with the GDR, one with Poland, three with Czechoslovokia, one with Hungary and one with Romania. Five topics were completed and applied, yielding total economic benefits of 693,000 leva.

Cooperation with Soviet organizations is closest and most fruitful. Extensive use is being made of new and more efficient methods. Ordinary exchange of information and samples, and coordination of scientific and technical research are yielding to division of labor in scientific research based on accords, agreements and contracts based on the share of participation of individual countries and the application of thus obtained results in the countries' industries.

In accordance with agreements with Soviet institutes, work is being done on the following topics:

With the VNIISV [All-Union Scientific Research Institute of Glass Fibers] in Kalinin: development of technological processes and of industrial production facilities for preparations and antistatic agents for synthetic and natural silks and fibers;

With the VNIISS [All-Russian Scientific Research Institute of Sugar Beets and Sugar] in Vladimir: development of a technological process and equipment for the production of porous materials for separators for battery equipment and pipe elements for land reclamation and irrigation;

With Main Microbiological Industry Administration and the All-Union Scientific Research Institute for Protein Synthesis: development of a technology and testing experimental models of equipment for the production of feed protein from methanol;

With NIIKHIMPOLIMER [Scientific Research Polymer Chemistry Institute] in Tambov: development of processes and installation of systems for the

production of harmless stabilizers for polyvinylchloride from available raw materials.

On the last two topics the TsIKhP is a valued partner not only of the USSR but other socialist countries as well (GDR, Czechoslovakia, Romania].

As a result of scientific research conducted jointly by the TsIKhP and the VNIIKHSZR [All-Union Scientific Research Institute of Chemicals Used for Plant Protection in Moscow], in the field of agrobiological testing of plant protection preparations and their registration for use in both countries, the following preparations were included in the list of items to be traded between Bulgaria and the USSR between 1986 and 1990:

Produced in the USSR: Dalapon, BMK, Diamet, Tamir and Dazon;

Produced by Bulgaria: IKhP-300 and chloracetophon-40.

The following topics are being developed jointly with specialists from the NIIRP [Scientific Research Institute of the Rubber Industry, Moscow]:

Systems and technologies for the production of heavy-duty conveyor belts for the ore-mining industry.

Recipes and technologies for the manufacturing of thick and porous parts for superhigh frequency systems with raw materials available in the socialist countries.

As a result of cooperation with the Plastik NPO [Scientific Production Association] in Moscow, on the basis of Soviet documentation adapted to Bulgarian units, a line of reinforced plastic hose operating under higher pressure is being produced at the Kom Plant. Economic benefits will total 200,000 leva. A line for the production of coiled pipes was commissioned at the Krustan Rakovski Plant. Work is continuing on the development of fireproof and antistatic polyethylene with a view to broadening the area of application of the pipes. Economic benefits are assessed at 150,000 leva.

Second in terms of volume and importance is our cooperation with the GDR.

Triavap, a preparation for the struggle against the whitefly, was developed and applied in Bulgaria as a plant protection chemical. Planned economic benefits will total 39,070 leva per year from the production of a minimal amount of 20 tons per year. Economic benefits from the production of the Water-Oil Ceazin-4 preparation totaled 186,000 for 250 tons per year. Preparations based on Fenturon, Trakefon and others are being developed.

Problems related to protecting and improving the environment and the efficient utilization of natural resources have become of prime importance in recent years. The TsIKhP is the country's coordinator of activities related to protecting the air from pollution with harmful substances, which is one of the topics in the CEMA plan. So far three problems of lowering the emission of

nitrogen oxides in industrial gas byproducts have been resolved successfully. In addition to ecological results, economic benefits totaling 194,000 leva per year have been achieved.

The further development and intensification of scientific and technical cooperation calls for relating it even more strongly to production-economic cooperation, more extensive joint utilization of worldwide scientific and technical achievements (licenses above all) and mastering the use of new equipment technologies.

Kostenets Chemical Plant

Sofia KHIMIYA I INDUSTRIYA in Bulgarian No 8, 1984 p 381

[Text] The chemical plant in Kostenets became part of the TsIKhP in 1982. This is the only engineering-application organization within the chemical industry system which combines an institute with a plant and science with production. The basic integration factor is the unified planning of scientific, design, application and production activities. All scientific tasks are production-oriented. In other words, the institute's topics are aimed at resolving the plant's problems.

This plant is the only enterprise in the country producing synthetic nitrogen-based dyes, optical bleaches and additives for acid brilliant copper coating, which meet some of the needs of the textile, motor vehicle and electronic industries.

The nitrogen-based dyes produced here are used in dyeing natural materials, such as cellulose, wool, furs, etc. A small percentage of acid dyes are successfully used in dyeing polyamide textile fibers.

The plant's production variety includes the following groups:

Direct dyes, 15 brands;

Acid dyes, 14 brands;

Acid dyes with subsequent chrome plating, four brands;

Optical bleaches, for:

Cellulose materials, two brands;

Washing detergents, two brands;

Synthetic materials, one brand;

Additives for acid brilliant copper lining, three brands.

The production of synthetic and artificial fibers has been developing at a fast pace for the past 10 years, leading to the restructuring of the light industry.

Traditional older dyes no longer meet the requirements of dyeing synthetic fibers and fabrics. A drastic change has taken place in the structure of dye consumption. In order to surmount a certain lag in dye production compared to the growth of the textile industry, the share and absolute consumption of such progressive groups of dyes was increased. This task is being successfully implemented by the TsIKhP, which developed several brands of progressive dyes within a short time. Pigment pastes for dyeing viscous materials in bulk and semifinished products for waterproof complex metal dyes are undergoing experimentation. A development which intensifies the drying process of pulverizing drying substances will undergo experimentation (jointly developed by the TsIKhP and the BRV). Polymer powders for protective coating, complex additives and many other materials are being developed which will update the existing variety and broaden the plant's production structure.

The plant has established a development and application base, whose main task is to apply new developments and update technologies and technological equipment.

A material base for laboratory studies and synthesis was quickly set up. A color laboratory is under construction. It will study the quality indicators of new dyes for possible semi-industrial dyeing.

This year, construction was undertaken of a general-purpose experimental-industrial shop at the base, which will be commissioned during the first quarter of 1985. This will encourage the rapid implementation of ideas--from applied research through experimentation and development to experimental production. Practical experience has indicated that the greatest difficulties are found in application, where the efforts and resources of science and production must be combined. It is in this area that the advantages of scientific-production integration are manifested most clearly as the organizational method covering the entire research-production cycle.

The plant has organized creative cooperation with the BAN IOKh [Organic Chemistry Institute] and IFKh [Physical Chemical Institute] and with university chairs and laboratories. Anything new and progressive developed by these scientific units is applied immediately.

The reconstruction of the shop for physical-mechanical dye processing will be undertaken in 1984-1985. Modern drying equipment, which will eliminate hard and unattractive labor, will be installed.

During the second reconstruction stage (1985-1988) the intensification of the synthesis of dyes will be completed with the installation of new technological equipment and the introduction of contemporary operational control methods. This will enable us to master the production of new brands of reaction monochlortriazine, complex-metal and waterproof dyes. The production of optical bleaches will be increased by mastering a variety of mixed articles made of polyester cellulose. The restructuring of direct and acid dyes in accordance with domestic and import requirements will be continued.

Following the completion of the overall intensification, reconstruction and modernization of plant capacities, dye production will double and the share of advanced dyes will be increased from 1 to 39 percent in 1989; the production of optical bleaches will increase by a factor of 2.5; the production of additives for acid brilliant copper lining (we are the only producers of such items within the CEMA system) will double.

TsIKhP Directors

Sofia KHIMIYA I INDUSTRIYA in Bulgarian No 8, 1984 pp 382-383

[Text] Dr Nastya Isakova, 1954-1958.

During that period the management of the newly created Scientific Research Institute for the Chemical Industry persistently struggled for the expansion of laboratories areas and recruiting cadres. The initial staff numbered 15-16 people, most of whom had previously worked at the Chemical Industry Administration Laboratory, which the NIIKhP inherited.

Originally the institute occupied the ground floor and an attic room. In 1957 it took over the premises of an abandoned soap-making factory at 5 Oporska Reka Street, which it repaired and reorganized. This marked a new stage in the development of the NIIKhP. The number of sections and the personnel were increased and the establishment of a modern material base was undertaken. The number of applied scientific developments augmented.

Despite the difficulties of the first 3 years of its life, the institute's collective developed a number of technologies. This involved increasing the production of aluminum sulfate and the production of manganese sulfate at the Angel Vulev DIP in Yambol, the comprehensive processing of 200 tons of silver coins at the chemical plant in Dimitrovgrad, the development and production of some new dyes at the Koloristka DIP, upgrading the quality of the cement produced at the DTsZ [State Cement Plant] in Temelkovo and others.

The institute's leadership formulated the original task of replacing the coke in the lime kilns with briquetted anthracite. In the course of a few months industrial experiments were prepared and carried out with several hundred tons of briquetted anthracite.

The April party line was applied in the institute's management and activities: democratization in management, making decisions coordinated with the party bureau, high exigency toward the entire personnel in fulfilling the topic plan and encouraging all creative initiatives.

Honored Worker In Technology Professor Engineer Nikola Videnov, 1958-1962

During this period the rapid overall development of the institute continued. The following auxiliary units were created and staffed in 1959: design-engineering bureau and machine-electrical engineering workshop. The institute's premises were enlarged, as a result of which the institute was the first of its kind in the country geared for the fast utilization of scientific developments.

Answering the party's call of concentrating production and management activities, in 1959 the institute publicly offered to merge with other similar institutes. The NIIKhP expanded in 1960 by absorbing the Glass and Fine Ceramics Institute, the Hides and Rubber Institute and the Forest Chemistry Section of the Timber Processing and Paper and Cellulose Institute. This merger played a positive role mainly as a result of the experience contributed by the individual units and the enrichment of practical activities with new initiatives and trends in applied science. The institute's staff increased to some 250 people employed in five different laboratories scattered throughout the city. The unification and growth of the institute required the elimination of such fragmentation and the construction of a plant based on modern requirements governing the development of applied scientific research. The institute's management succeeded in acquiring the necessary financing for the construction of the plant and its staff undertook to develop the layout. Construction began in October 1962.

Between 1958 and 1962 the NIIKhP undertook work on more extensive scientific developments for the chemical industry. The Inorganic Technology Section undertook studies on the hydrometallurgy of Kremikovtski ore, while the Organic Synthesis Section began work on low-volume chemicals. The Plastiks Section worked on the development of new polymers; the Rubber Section worked on upgrading the quality of tires and other items; the Forest Chemistry Section undertook work on biotechnology for the production of protein, etc.

Honored Worker In Technology Senior Scientific Associate Georgi Monov, 1962-1966.

During this period the new building of the institute was completed. It included areas for machine and electrical engineering workshops. Conditions were provided for expanding the scientific and technical information section, the library, the design-engineering section and others.

Scientific cadres--the best guarantee for the development of a scientific unit--developed. A Plant Protection Section was created and strengthened. The development of major problems was undertaken, such as the utilization of all components contained in the Kremikovtski ore and Medet Sterol, the production of new types of plant protection chemicals, the oxidizing of various petroleum fractions, the development of technologies for new plastics, such as polyformaldehydes, etc.

The production of a number of valuable chemicals for agriculture and animal husbandry was undertaken, such as:

Dicalcium phosphate--a basic mineral part of food mixtures contributing to the growth of the livestock, without which no modern cattle and poultry breeding is conceivable. The economic and social results of this output are substantial. Annual output rose from 5,000 to 30,000 tons which, nevertheless, is still insufficient;

The production of a defoliant based on magnesium chlorate, for the mechanized growing of cotton, etc.

Professor Engineer Ivan Kurshev, 1966-1971

The most characteristic feature in the institute's activities during that period was its transformation into an engineering-technological institute for servicing the chemical industry. Organization and structural changes were made in order to achieve this basic objective: the design-engineering department was expanded and strengthened; the machine workshop was expanded to the point of manufacturing and assembling non-standard equipment and semi-industrial systems; a production-experimental base was set up for testing individual processes and technologies under pilot conditions; a laboratory for various processes and apparatus and a technical-economic studies section were created; the scientific and technical information section undertook the publication of extensive information on newly published books and on a variety of problems of interest to the scientific units, departmental periodical publications, etc.

The institute's work standards and quality of developments improved significantly. Five to seven projects were completed annually with combined economic benefits of 3.5-7.0 million leva. Technological regulations and assignments were drafted.

Work on the following important topics was done during that period: "Rendering Harmless and Utilizing Waste Gases From the Production of Sulfuric Acid at the Chemical Plant in Dimitrovgrad"; "Rendering Harmless and Utilizing Gases Containing Sulfur Dioxide at the G. Damyanov MDK [Copper Extraction Combine]"; "Technology for the Production of Complex Fertilizers Based on Phosphorite, Phosphoric Acid and Ammonium Nitrate"; "Technology for Processing Substandard Barite Concentrate at the L. I. Breshnev MK [Metallurgical Combine]"; "Technology for Polyformaldehyde Production"; "Technology for the Production of Symmetrical Triazene Preparations"; "Technology for the Production of the Nereb Fungicide"; and others.

Honored Worker In Sciences Professor Doctor of Chemical Sciences Ivan Mladenov, 1971-1973.

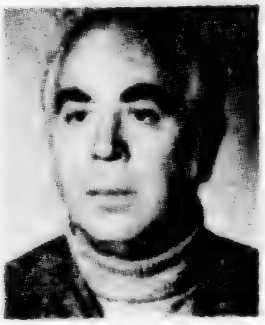
There were three most characteristic aspects of the institute's development during that period: first, the unification of all scientific research and development units (excluding pharmacy and plastics) of the Ministry of Chemical Industry System within a unified Center for Scientific Research and Development (TsNIRD). It included the Rubber Industry Institute, Chemical Industry Institute, Low-Volume Chemicals Institute and Petroleum Chemistry and Petroleum Refinery Institute, the BRV in Yambol and Vidin and the BRV for

solid fuels and study of petroleum deposits. The pilot installations were assigned to the institute. The purpose of the reorganization was to develop close ties between science and production and to develop and provide technologies suitable for practical utilization.

For the first time, science, development and production were combined within a single plan. The institute's director became deputy general director of the DSO as well. The institute also developed production activities. Its bases employed more than 400 people. The size of the institute's staff increased significantly, reaching some 680 people, including two professors, 14 associates and 16 candidates of sciences. The institute set up its own scientific council staffed by academic-rank members.

Having reached the age of its creative maturity, the institute strove steadily to provide most efficient and highly effective solutions to tasks and problems facing the scientific front.

Professor Candidate of Chemical Sciences Engineer Lyuben Yankov, 1973-1979.



This period was characterized by intensive searching and steady efforts to develop a viable and most adequate scientific-application organization and to find new means and methods for adapting scientific research and development to present and future needs. The basic requirements of scientific research were formulated: broadening the raw material base of the chemical industry through the utilization of local raw materials, full and more skillful utilization of all semifinished and byproducts and technological waste with a view to their processing in depth and developing wasteless technologies; improving existing chemical technologies on the basis of domestic and foreign scientific and technical achievements; developing and applying technologies for the production of a wide variety of chemical products with a view to eliminating imports, etc.

The main task of the institute was to provide scientific services to the inorganic and rubber industries, the production of chemical fibers, etc. Comprehensive staffs of specialists capable of developing the overall research, application and production process were organized in order to ensure the qualitative and fast development and application of assignments. This enabled the institute to resolve any number of important technological and economic problems of the subsectors it serviced: development and application of technology for the production of phosphate-phosphorite fertilizer,

antifoaming agents, furane and other condensation resins used in metal casting, a thermostabilizer and thermostabilized polyamide resins and fibers used in the production of spare parts and auxiliary materials for textile machinery, optimizing the Beckmann rearrangement in the production of caprolactam and others, with total economic benefits for the institute of 4-10 million leva per year.

Senior Scientific Associate Candidate of Technical Sciences Engineer Dacho Dimitrov, 1979.

In 1979 the Central Institute for the Chemical Industry was created on the basis of the Scientific Research Institute for the Chemical and Rubber Industry and the Scientific Research Institute for the Processing of Plastic Materials, with the following assignments: study, scientific research, design and development of technologies, experimental production and application of scientific and technical achievements in the chemical industry. The same year the TsIKhP was awarded the Red Labor Banner Order. The chemical plant in Kostenets became part of the institute as of 1 January 1983.

During that period great efforts were made to hire younger personnel and to update the institute's material and technical facilities. Compared to 1979, the 1983 capital-labor ratio increased by 30 percent.

The chemical complex introduced a large number of significant technologies developed by the institute's collective, resulting in the development of new raw and other materials and products, improving production quality, conserving material resources, reducing imports, etc. Scientific and technical development standards were enhanced, as was the aspiration to raise developments to the level of discoveries.

The TsIKhP was awarded seven gold medals at the 1983 International Autumn Technical Fair in Plovdiv; it was awarded second prize at the competition sponsored by the State Committee for Science and Technical Progress and RABOTNICHESKO DELO for the application of significant developments, first prize among the IVO in the V. Levski and Iskur districts for overall results and economic benefits, and a certificate of the Bulgarian Trade Unions Central Council, the Komsomol and the Central Council of the Scientific and Technical Union for winning the competition for the conservation of raw materials, materials and energy.

Greeting Messages

Sofia KHIMIYA I INDUSTRIYA in Bulgarian No 8, 1984 p 384

[Text] Candidate of Technical Sciences Engineer Tseko Kamenov, general director of the SKhK in Vidin:

The joint activities of the TsIKhP at the SKhK in Vidin began with the commissioning of the combine. Guided by noted institute specialists, the problem of the heat stabilization of cord fibers was resolved successfully; an apparatus for melting technological waste from the production of PKA fibers was designed and commissioned; studies were made of the processes of destruction of elastomers and vulcanizers and means and methods for their stabilization were developed; a technology was applied for the production of filled elastic tires, for the production of radial fillers for shafts and filled shapes. A technology for the production of plates on the basis of ethylenepropylene rubber is being jointly developed for the needs of the ZTKI in Kula.

Stoyan Evtimov, general director of the SKhK in Devnya:

Cooperation between the SKhK in Devnya and the TsIKhP covers the following major areas:

In scientific and technical information and forecasting: constant contacts are maintained involving the exchange of information and forecasts and concepts on the development of the production of soda ash, caustic soda and chlorine are formulated jointly;

Soda production: projects related to reducing energy outlays and soda production intensification and modernization are developed jointly by the TsIKhP, the VKhTI in Sofia and the KNIPI in Devnya.

A mechanical heat compressor will be installed to utilize secondary power resources (the heat generated by the waste distillation liquid). In order to lower energy expenditures a two-stage filtration of the bicarbonate is being tried, with additives aimed at reducing the moisture in the semifinished product. In order to reduce ammonia outlays efforts are being made to change the existing technological distillation system. Specialists from the combine, the KNIPI and the TsIKhP are developing fertilizer production, suspension polymerization of vinylchloride and the synthesizing of polyvinyl alcohol.

Candidate of Technical Sciences Engineer Kiril Petkov, general director of the SKhK in Vratsa:

The SKhK in Vratsa highly values the contribution of the TsIKhP updating the consumer qualities of output and the development of advanced technologies and new products.

Considerable savings in packaging has been achieved and carbamide has become competitive on the international market as a result of a technology developed by the TsIKhP for the production of non-compacting carbamide shipped in bulk.

The new liquid and suspended fertilizers will significantly reduce losses of nutritive substances and a considerable percentage of manual labor will be eliminated in their transportation.

Grateful for many years of fruitful activities, we congratulate the TsIKhP collective on the occasion of its 30th anniversary and wish it new creative successes.

Engineer Ivan Ivanov, general director of the SKhK in St. Zagora:

As the leading engineering-application organization in the chemical sector, for many years the TsIKhP has provided prompt and competent assistance to the SKhK in Stara Zagora in resolving many technological problems. Joint work has been done to develop a number of topics aimed at improving the work of individual production assemblies at the Nitric Acid, Ammonium Saltpeter and Caprolactam Production Shops. Highly efficient technologies for the production of Fixal sheet fertilizer, monopotassium phosphate and calcium nitrate were developed through joint efforts between 1980 and 1983. Joint work is also under way to improve the quality of output, to utilize waste products and to apply biotechnologies in the production of industrial monocellular protein and other bioproducts.

Rusko Ishmeriev, general director of the SKhK in Yambol:

Cooperation between the TsIKhP and the Dimitur Dimov SKhK in Yambol has been quite successful and fruitful. After the system for the production of PE fibers and PE silk were commissioned, a number of problems in upgrading the quality of output and saving on capitalist currency were resolved jointly. In 1976 the institute and the combine applied their own invention on dyeing of PE resins in bulk with economic benefits of 155,000 leva per year. Another institute collective developed an original method for greasing synthetic fibers, with annual economic benefits of 155,000 leva. Yet another institute collective developed an original means for greasing synthetic silks with annual economic benefits of 89,000 leva. A compound for the manufacturing of PE silk threads was successfully developed and applied, using exclusively local raw materials, with economic benefits of 58,000 leva and saving on capitalist currency by eliminating imports.

Honored Worker in Technology Engineer Aleksandur Khazarosyan, general director of the Verila SKBKh:

The joint activities of the TsIKhP and the Verila SKBKh is a good example of efficient joint work between an institute and a combine. Very good results have been achieved so far from such scientific and technical cooperation. Suffice it to mention the development of the Verin T antifrothing agent and the production of polyethyleneglycols to gain an idea of the scale of our joint efforts.

We are pleased by the fact that future effective cooperation will be intensified and expanded.

Dancho Doganov, general director of the SKhK in Botevgrad:

The TsIKhP has made a great contribution to the development of our chemical industry, the contemporary level it has reached and the mastering of new technologies and products. The competence and feeling of responsibility and depth of the work of the institute's specialists made the TsIKhP a sought-after partner in our joint work.

We are sincerely pleased to offer our warmest congratulations to the institute on the occasion of its anniversary and our wishes for the good health of the entire collective and for new creative successes in implementing BCP policy in chemistry and scientific and technical progress.

Engineer Ivan Vladikov, general director of the Narodna Republika SKPP:

The Narodna Republika SKPP and the TsIKhP have developed and applied jointly a number of technologies, such as the production of solid foil PVKh for the pharmaceutical and food industries, a pallet container for the textile industry, new varieties of froth plastic items, a new type of hardhat for construction workers, battery shells for Balkankar, corrugated plastic and boxes and vacuum-shaped discardable containers for use by the Balkan BGA, with total economic benefits in excess of 2 million leva.

On the occasion of the 30th anniversary of the TsIKhP, the labor collective of the Narodna Republika SKPP in Sofia offers its warm congratulations to its colleagues in the Plastic Industry Area, wishing them even greater creative successes in attaining the peaks of chemical science.

Ivan Avramov, general director of the Kristal LKhZ in Velingrad:

For the past 10 years close creative ties have existed between the TsIKhP and the Kristal LKhZ in Velingrad in the study, production and use of furane resins and hardeners in metal casting. These developments have been very useful to the national economy. They have yielded high economic results and offered possibilities of even faster development of our machine building. Without such partnership and the dedicated work of the TsIKhP collective such problems could not have been resolved promptly and purposefully.

We hope that our joint work will continue and that good relations and exchange of knowledge and experience will lead to new and even greater successes.

Summary

The Central Institute for Chemical Industry is a leading research and engineering organization of the National Corporation for Chemical Industry and plays an active part in the whole process of development of the branch. The institute systematically and thoroughly works on the formation of unified scientific and technical policy in the field of chemical industry, on the improvement of the research level and the implementation of new processes and technologies, on the increase in efficiency and export abilities of the chemical complex. The central part of the institute's scope of activity is covered by the development of new advanced, small-waste and wasteless technologies, new and improved raw materials, products and articles. The institute also works on various construction, replacement of import raw materials and compounds, replacement of import raw materials and compounds in short supply, increase of the share of national raw materials, maximum utilization of metal scraps and waste products.

The Central Institute for Chemical Industry implements 35-40 new technologies per year in production of plant protection chemicals, dyes, optical bleaching agents, semiproducts, polymer compositions against corrosion, rubber and plastic articles, etc. Only for the 1971-1983 period more than 350 scientific themes have been implemented with total annual economic effect more than 80 million leva and currency economy--21 million leva. All that is a great contribution to the chemization of different industrial branches, agriculture, etc.

Qualified specialists from the institute have broad experience in the study and realization of the leading Soviet experience as well as of the other CEMA countries. The institute keeps close contact and collaborates with 11 similar institutes and scientific-manufacturing organizations from different countries. The experience of leading foreign firms and companies in the field of chemistry and chemical industry is mainly used by participating in the import and implementation of 15 licenses realizing total economic savings of 15 million leva per year.

Over the entire period since its founding the Central Institute for Chemical Industry has proved its strength, abilities and ambitions to fulfill the important tasks approved by the 12th Congress of the Bulgarian Communist Party and the National Party Conference on Quality for accelerated realization of up-to-date achievements of the scientific-technical progress.

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